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COMBUSTION AND HEAT TRANSFER; VOLUME 2 - ADVANCED JET FUELS DATA SETS

S. Zabarnick, D. R. Ballal, K. E. Binns
G. L. Dieterle, J. S. Ervin, R. R. Grinstead
S. P. Heneghan, D. H. Kalt, R. E. Kauffman
W. A. Rubey, R. C. Striebich, M. D. Vangsness
T. F. Williams

University of Dayton Research Institute
300 College Park
Dayton, OH 45469-0001

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Charles W. Frayne

CHARLES W. FRAYNE
Combustion Branch
Propulsion Sciences and
Advanced Concepts Division

Charlotte R. Eigel

CHARLOTTE R. EIGEL
Chief, Combustion Branch
Propulsion Sciences and
Advanced Concepts Division

Leo S. Harootyan Jr

LEO S. HAROOTYAN, JR.
Deputy
Propulsion Sciences and
Advanced Concepts Division

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S. Zabarnick, D.R. Ballal, K.E. Binns, G.L. Dieterle, J.S. Ervin, R.R. Grinstead, S.P. Heneghan, D.H. Kalt, R.E. Kauffman, W.A. Rubey, R.C Striebich, M.D. Vangsness, and T.F. Williams

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300 College Park
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This report consists of data set summaries of tests performed in support of the development of advanced jet fuels, including JP-8+100, JP-900, and endothermic fuels. This includes data sets for the quartz crystal microbalance (QCM), the isothermal corrosion oxidation test (ICOT), the Phoenix rig, the fuel/materials compatibility studies, the extended duration thermal stability test (EDTST), and the advanced reduced scale fuel system simulator (ARSFSS). These data sets, and/or more complete versions of them, may also be available in electronic format on the internet at https://posfbbs.appl.wpafb.af.mil or directly from the authors. The overall program accomplishments and details of the individual test devices employed during the contract period are contained in the accompanying volume entitled, "Combustion and Heat Transfer; Volume 1 – Advanced Jet Fuels Studies."

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PREFACE

This final report was submitted by the University of Dayton Research Institute (UDRI) under Contract No. F33615-92-C-2207, sponsored by the U.S. Air Force Research Laboratory, Propulsion Directorate, Wright-Patterson AFB, OH. Mr. Charles Frayne of AFRL/PRSC was the Contract Monitor and Dr. D.R. Ballal of the Aerospace Mechanics Division, UDRI was the Principal Investigator. This report covers work performed during the period June 8, 1992 through December 31, 1997.

The authors would like to acknowledge the support and encouragement of Dr. Mel Roquemore and Mr. Bill Harrison of the U.S. Air Force.

1. INTRODUCTION AND SUMMARY

This report consists of data set summaries of tests performed in support of the development of advanced jet fuels, including JP-8+100, JP-900, and endothermic fuels. This includes data sets for the quartz crystal microbalance (QCM), the isothermal corrosion oxidation test (ICOT), the Phoenix rig, the fuel/materials compatibility studies, the extended duration thermal stability test (EDTST), and the advanced reduced scale fuel system simulator (ARSFSS). These data sets, and/or more complete versions of them, may also be available in electronic format on the internet at https://posfbbs.appl.wpafb.af.mil/ or directly from the authors.

For the development of JP-8+100 fuel, we have tested hundreds of additives in both small and large scale test devices. We formulated combinations of the best additives (detergent/dispersant, hindered phenol antioxidant, and metal deactivator) and demonstrated their efficacy in reducing deposition in realistic aircraft conditions in large-scale simulator rigs. We optimized the concentrations of these additives for maximum effectiveness and minimum cost. We performed extensive studies of the compatibility of these fuel additives with current and future aircraft fuel system materials. We determined that the current best additives show no negative effects on both metallic and non-metallic fuel system materials.

We also performed extensive studies on the fundamental processes of fuel oxidation, deposition, and pyrolysis. We developed chemical kinetic mechanisms which can simulate the oxidation and deposition processes. We performed experimental and modeling studies on fuel cooling which shows that deposition which occurs in fuel cooling heat exchangers can be a significant problem in fuel system design. We demonstrated an inverse relationship between oxidation and deposition over a range of fuels, and showed that our chemical kinetic mechanism can be used to explain this seemingly anomalous result. We developed statistical techniques to assist the evaluation of jet fuel additives, thermal stability measurements, and aircraft field performance. We developed a wide variety of fuels analysis techniques for measurement of the following: dissolved oxygen, detergent/dispersant capacity, antioxidants and phenolics, hydroperoxides, trace jet fuel compounds, metal deactivators, products of endothermic reforming, dissolved and free water in fuel, BHT, Betz dispersant, and elemental metals. We explored alternative techniques for reducing jet fuel deposition including: removal of dissolved oxygen, silylating agents, oxygen scavenging additives, and solid-phase extraction.

We also made progress in support of development of future fuels such as JP-900 and endothermic fuels. We explored the effect of supercritical fluid properties on high temperature fuels. We have begun to study the pyrolysis of fuel in catalytic and non-catalytic reaction systems.

The overall program accomplishments and details of the individual test devices employed during the contract period are contained in the accompanying volume entitled, "Combustion and Heat Transfer: Volume 1 – Advanced Jet Fuel Studies."

2. QUARTZ CRYSTAL MICROBALANCE DATA

The Quartz Crystal Microbalance (QCM) was developed and first used for the study of jet fuel thermal stability by Sandia National Labs (1). It enables the real-time, *in situ* measurement of extremely low amounts of deposits (<100 ng/cm^2). We originally acquired a QCM system in 1993 from Sandia and made numerous additions and operating modifications. As a result of these changes the QCM system has been used extensively for evaluating additives and for fundamental studies of fuel oxidation and deposition (2). These modifications include the addition of a pressure transducer and oxygen sensor to enable the direct *in situ* monitoring of the oxidation process (3). For most testing we have chosen to operate the device under relatively low oxygen availability which more closely approximates that of real fuel systems (4).

During the contract period, we utilized the QCM system for over 1300 fuel tests encompassing additive testing and fundamental studies. Hundreds of JP-8+100 additive candidates were tested with the device. These test results are compiled in a series of UDR technical reports (5-7). The QCM was also used extensively for additive concentration optimization and additive package development (8). In fact, the current JP-8+100 dispersant-antioxidant-metal deactivator combination was first tested and proven successful in the QCM (4). The device has also been used extensively for testing of JP-8 and JP-8+100 fuel samples from the Air National Guard (ANG) field trials; these tests have confirmed that the JP-8+100 additive package has shown significant improvement in oxidation and deposition properties for fuels used in actual ANG aircraft.

Table 1 contains a chronological list of experiments performed in the QCM. The table lists the run number, the fuel number, additive names and concentrations, the temperature of the run, the gas used for saturating the fuel and headspace, the final deposition at the end of a 15 hour run, and the QCM electrode material. Fuel and additive numbers (POSF codes) are assigned by the Fuels Branch of the Fuels and Lubrication Division of Wright Laboratory (WL/POSF), WPAFB, OH. Runs were performed using three separate QCM devices; runs labeled ssz... and steve... were conducted on QCM system #1, runs labeled qcm... were conducted on QCM system #2, and runs labeled pz... were conducted on QCM system #3. Duplicate runs performed on the three systems yield results that are in substantial agreement. Deposition and oxidation plots for each of these runs can be obtained by referencing the appropriate technical report which details the chosen run (5-7). The plotted data are also available from the authors as a Filemaker Pro database file which is about 50 megabytes in size.

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Table 1. List of QCM Experiments

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
Steve01	2827	140	Air	5.1	Au
Steve02	2747	140	Air	2.3	Au
Steve03	2799	140	Air	1.7	Au
Steve04	2799	140	Air	1.4	Au
Steve05	2747	140	Oxygen	0.9	Au
Steve06	2747	140	Air	0.4	Au
Steve07	2747	140	Oxygen	1.1	Au
Steve08	2747	140	Air	0.7	Au
Steve09	2827	140	Air	2.6	Au
Steve10	2827	160	Air	4.0	Au
Steve11	2827	180	Air	1.8	Au
Steve12	2827	150	Air	7.9	Au
Steve13	2827	150	Air	6.7	Au
Steve14	2827	150	Air	7.6	Au
Steve15	2827	140	Air	4.0	Au
Steve16	2827	150	Air	6.9	Au
Steve17	2747	140	Air	0.6	Au
Steve18	2747	160	Air	0.6	Au
Steve19	2747	180	Air	0.8	Au
Steve20	2747	140	Nitrogen	0.3	Au
Steve21	2827	140	Nitrogen	0.2	Au
Steve22	2827 after solid phase extraction	140	Air	0.5	Au
Steve23	2747 w/ 2827 solid phase extract	140	Air	2.8	Au
Steve24	2926	140	Air	5.0	Au
Steve25	2827	140	Air	3.7	Au
Steve26	2827 w/di-t-butyl peroxide	140	Air	2.8	Au
Steve27	2926	140	Air	2.9	Au
Steve28	2922	140	Air	2.0	Au
Steve29	2747	140	Air	0.7	Au
Steve30	2827 w/ 2,2 azobis-2-methyl propionitrile 0.178 g/100 ml	140	Air	7.5	Au
Steve31	2827	140	Air	2.7	Au
Steve32	2827 w/ 8Q405 100 mg/l and MCP-477 300 mg/l	140	Air	0.5	Au
Steve33	2799	140	Air	1.0	Au
Steve34	2893 (JPTS w/o JFA-5)	140	Air	0.6	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
Steve35	n-dodecane	140	Air	0.1	Au
Steve36	n-dodecane w/ 2827 solid phase extract	140	Air	0.3	Au
Steve37	2928	140	Air	3.2	Au
Steve38	2959	140	Air	2.5	Au
Steve39	2922 clay treated	140	Air	0.4	Au
Steve40	2934	140	Air	6.5	Au
Steve41	2936	140	Air	6.9	Au
Steve42	2827 w/ 8Q405 100 mg/l	140	Air	0.7	Au
Steve43	2827 w/ JFA-5 12 mg/l	140	Air	5.7	Au
Steve44	2827 w/ MDA 10 mg/l	140	Air	1.7	Au
Steve45	2934	140	Air	5.0	Au
Steve46	2827 w/ Cu acetate monohydrate 50 ppb	140	Air	3.4	Au
Steve47	2922 w/ 8Q405 100 mg/l and MCP-477 300 mg/l	140	Air	0.3	Au
Steve48	2934 w/ 8Q405 100 mg/l and MCP-477 300 mg/l	140	Air	0.5	Au
Steve49	2936 w/ 8Q405 100 mg/l and MCP-477 300 mg/l	140	Air	4.0	Au
Steve50	2827 w/ Cu naphthenate 50 ppb	140	Air	2.3	Au
Steve51	2827 w/ JP-8 additives	140	Air	2.5	Au
Steve52	2747 w/ JP-8 additives	140	Air	0.4	Au
Steve53	2827 w/ JP-8 additives, 8Q405 100 mg/l, and MCP-477 300 mg/l	140	Air	0.6	Au
Steve54	2928 w/ JFA-5 12 mg/l	140	Air	10.2	Au
Steve55	2928 w/ 8Q405 100 mg/l	140	Air	2.7	Au
Steve56	2934 w/ JFA-5 12 mg/l	140	Air	5.1	Au
Steve57	2922 w/ JFA-5 12 mg/l	140	Air	3.7	Au
Steve58	2936 w/ JFA-5 12 mg/l	140	Air	5.5	Au
Steve59	2827 w/ JFA-5 6 mg/l	140	Air	4.5	Au
Steve60	2827 w/ JFA-5 24 mg/l	140	Air	6.4	Au
Steve61	2827 w/ 8Q405 50 mg/l	140	Air	0.6	Au
Steve62	2827 w/ 8Q405 10 mg/l	140	Air	3.3	Au
Steve63	2926 w/ JP-8 additives (EGME)	140	Air	2.1	Au
Steve64	2926	140	Air	4.1	Au
Steve65	2926 w/ JP-8 additives (DiEGME)	140	Air	1.4	Au
Steve66	2922 w/ 8Q405 10 mg/l	140	Air	3.5	Au
Steve67	2827 w/ 8Q405 25 mg/l	140	Air	3.3	Au
Steve68	2922 w/ 8Q405 100 mg/l	140	Air	3.2	Au
Steve69	2922 w/ 8Q405 50 mg/l	140	Air	4.3	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
Steve70	2922 w/ 8Q405 50 mg/l and MCP-477 50 mg/l	140	Air	1.6	Au
Steve71	2922 w/ MCP-477 50 mg/l	140	Air	5.1	Au
Steve72	2922	140	Air	2.9	Au
Steve73	2963	140	Air	6.1	Au
Steve74	2963 w/ 8Q405 100 mg/l	140	Air	3.8	Au
Steve75	2922 w/ TBHQ 25 mg/l	140	Air	3.2	Au
Steve76	2922 w/ BHT 25 mg/l	140	Air	4.0	Au
Steve77	2922 w/ 2927 (phenylenediamine AO) 25 mg/l	140	Air	5.6	Au
Steve78	2922 w/ 2927 25 mg/l and 8Q405 100 mg/l	140	Air	2.5	Au
Steve79	2922 w/ BHT 25 mg/l and 8Q405 100 mg/l	140	Air	0.2	Au
Steve80	2936 w/ BHT 25 mg/l and 8Q405 100 mg/l	140	Air	5.4	Au
Steve81	2926 w/ BHT 25 mg/l and 8Q405 100 mg/l	140	Air	0.6	Au
Steve82	2827 w/ BHT 25mg/l and 8Q405 100 mg/l	140	Air	0.9	Au
Steve83	2934 w/ BHT 25 mg/l and 8Q405 100 mg/l	140	Air	3.7	Au
Steve84	2963 w/ BHT 25 mg/l and 8Q405 100 mg/l	140	Air	2.6	Au
Steve85	2827 w/ JFA-5 200 mg/l	140	Air	8.0	Au
Steve86	2980	140	Air	7.4	Au
Steve87	2980 w/ BHT 25 mg/l, 8Q405 100 mg/l, and MCP-477 300 mg/l	140	Air	0.6	Au
qcm0001	2827	140	Air	8.4	Au
Steve88	2981	140	Air	9.2	Au
qcm0002	2934 w/ BHT 25 mg/l and 8Q405 100 mg/l	140	Air	5.0	Au
qcm0003	2980 w/ BHT 25 mg/l, 8Q405 100 mg/l, and MCP-477 300 mg/l	140	Air	0.8	Au
Steve89	2981 w/ BHT 25 mg/l, 8Q405 100 mg/l, and MCP-477 300 mg/l	140	Air	0.5	Au
qcm0004	2827 w/ JFA-5 12 mg/l	140	Air	7.9	Au
qcm0005	2827 w/ BHT 25 mg/l, 8Q405 100 mg/l, and MCP-477 300 mg/l	140	Air	0.5	Au
Steve90	2827 w/ JFA-5 12 mg/l	140	Air	4.3	Au
Steve91	2922 w/ MCP-477 50 mg/l	140	Air	3.0	Au
qcm0006	2922 w/ 8Q405 50 mg/l	140	Air	3.0	Au
Steve92	2936 w/ BHT 25 mg/l, 8Q405 100 mg/l, and MCP-477 300 mg/l	140	Air	0.8	Au
Steve93	2827 w/ 7R30 100 mg/l	140	Air	6.2	Au
qcm0007	2936 w/ 7R30 100 mg/l	140	Air	8.9	Au
Steve 94	2747	140	Air	1.0	Au
qcm0008	2934 w/ 7R30 100mg/l	140	Air	9.8	Au
Steve 95	2747 w/ BHT 25mg/l, 8Q405 100mg/l, MCP-477 300mg/l	140	Air	0.2	Au
qcm0009	2827 w/ JP-8 add, 8Q405 100mg/l, MCP-477 300mg/l	140	Air	0.4	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
Steve 96	2827 w/ 8Q405 (New) 100mg/l	140	Air	0.9	Au
qcm0010	2827 w/ JP-8 additives	140	Air	3.5	Au
Steve 97	2827 w/ JP-8 add, 8Q405 100mg/l	140	Air	0.4	Au
Steve 98	2963 w/ BHT 25 mg/l, 8Q405 100 mg/l, and MCP-477 300 mg/l	140	Air	0.6	Au
Steve 99	2964 (Preproduction JP-7)	140	Air	0.9	Au
qcm0011	2926 w/ BHT 25 mg/l, 8Q405 100 mg/l, and MCP-477 300 mg/l	140	Air	0.8	Au
qcm0012	2980 w/ JP-8 additives	140	Air	6.6	Au
ssz100	2922 w/ JP-8 additives	140	Air	1.5	Au
ssz101	2893 (JPTS w/o JFA-5) w/ AO from JFA-5	140	Air	1.7	Au
ssz102	2934 w/ BHT 25 mg/l, 8Q405 100 mg/l, and MCP-477 300 mg/l	140	Air	1.7	Au
ssz103	2985	140	Air	10.1	Au
ssz104	2934 w/ 8Q405 400 mg/l and BHT 25mg/l	140	Air	9.2	Au
qcm0014	2936 w/ 8Q405 400 mg/l and BHT 25 mg/l	140	Air	3.0	Au
ssz105	2963 w/ 8Q405 400 mg/l and BHT 25 mg/l	140	Air	0.4	Au
qcm0015	2985 w/ 8Q405 100 mg/l	140	Air	6.9	Au
ssz106	2985 w/ BHT 25 mg/l, 8Q405 100 mg/l, and MCP-477 300 mg/l	140	Air	2.0	Au
ssz107	2893 w/ MDA 2 mg/l	140	Air	1.1	Au
qcm0016	2985 w/ BHT 25 mg/l and 8Q405 100 mg/l	140	Air	4.5	Au
ssz108	2985 w/ JFA-5 12 mg/l	140	Air	10.6	Au
ssz109	2827 w/ 2957 0.006% by volume	140	Air	8.1	Au
qcm0017	2827 w/ 2958 0.019% by weight	140	Air	2.6	Au
ssz110	2893 w/ FOA-2 5 mg/l	140	Air	0.3	Au
ssz111	2827 w/ MCP-1411 300 mg/l	140	Air	1.3	Au
qcm0018	2827 w/ MCP-1020 300 mg/l	140	Air	1.1	Au
ssz112	2827 w/ MCP-1025 300 mg/l	140	Air	0.8	Au
qcm0019	2827 w/ MCP-147B 300 mg/l	140	Air	0.8	Au
ssz113	2827 w/ MCP-1408B 300 mg/l	140	Air		Au
qcm0020	2827 w/ MCP-1411 300 mg/l	140	Air	1.3	Au
ssz114	2980 w/ JFA-5 12 mg/l	140	Air	7.4	Au
qcm0021	2922 w/ JFA-5 12 mg/l	140	Air	3.2	Au
ssz115	2980 w/ 8Q405 100 mg/l	140	Air	0.1	Au
ssz116	2980 w/ BHT 25 mg/l and 8Q405 100 mg/l	140	Air	0.2	Au
qcm0022	2926 w/ 8Q405 100 mg/l	140	Air	6.4	Au
ssz117	2922 w/ 8Q405 100 mg/l, BHT 25 mg/l, and JP-8 additives	140	Air	0.3	Au
qcm0023	2926 w/ 8Q405 100 mg/l, BHT 25 mg/l, and JP-8 additives	140	Air	1.0	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
ssz118	2980 w/ 8Q405 100 mg/l, BHT 25 mg/l, and JP-8 additives	140	Air	0.4	Au
qcm0024	2827 w/ 8Q405 100 mg/l, BHT 25 mg/l, and JP-8 additives	140	Air	0.8	Au
ssz119	2747 w/ 8Q405 100 mg/l, BHT 25 mg/l, and JP-8 additives	140	Air	0.2	Au
ssz120	2922 w/ MCP-1025 300 mg/l	140	Air	0.5	Au
qcm0025	2922 w/ MCP-147B 300 mg/l	140	Air	0.3	Au
ssz121	2976 (JPTS)	140	Air	0.7	Au
qcm0026	2922 w/ BHT 10 mg/l	140	Air	4.2	Au
ssz122	2922 w/ BHT 50 mg/l	140	Air	1.7	Au
qcm0027	2922 w/ BHT 100 mg/l	140	Air	4.9	Au
ssz123	2980 w/ MCP-147B 300 mg/l	140	Air	0.9	Au
qcm0028	2922 w/ BHT 50 mg/l	140	Air	4.7	Au
qcm0029	2980 w/ MCP-1025 300 mg/l	140	Air	1.7	Au
ssz124	2926 w/ 8Q405 100 mg/l and MCP-147B 300 mg/l	140	Air	0.2	Au
ssz125	2922 w/ 8Q405 100 mg/l and MCP-147B 300 mg/l	140	Air	0.2	Au
qcm0030	2926 w/ 8Q405 100 mg/l	140	Air	2.8	Au
ssz126	2799 (JPTS- failed JFTOT)	140	Air	0.7	Au
qcm0031	2980 w/ Exxon #12 25 mg/l	140	Air	4.7	Au
ssz127	2980 w/ Exxon #12 25 mg/l and 8Q405 100 mg/l	140	Air	0.7	Au
qcm0032	2922 w/ Exxon #12 25 mg/l and 8Q405 100 mg/l	140	Air	1.1	Au
ssz128	2926 w/ Exxon #12 25 mg/l and 8Q405 100 mg/l	140	Air	2.0	Au
qcm0033	2827 w/ Exxon #12 25 mg/l and 8Q405 100 mg/l	140	Air	0.6	Au
ssz129	2922 w/ Exxon #12 25 mg/l	140	Air	2.7	Au
qcm0034	2980	140	Air	5.0	Au
ssz130	2985 w/ MCP-147B 300 mg/l	140	Air	2.0	Au
ssz131	2985 w/ MCP-1025 300 mg/l	140	Air	4.0	Au
qcm0035	2922 w/ BHT 25 mg/l and MCP-147B 300 mg/l	140	Air	0.1	Au
ssz132	2926 w/ BHT 25 mg/l and MCP-147B 300 mg/l	140	Air	1.4	Au
qcm0036	2980 w/ BHT 25 mg/l and MCP-147B 300 mg/l	140	Air	0.5	Au
ssz133	2985	140	Nitrogen	0.6	Au
qcm0037	2926 w/ JFA-5 12 mg/l	140	Air	6.0	Au
ssz134	2922 w/ MCP-1408C 25 mg/l	140	Air	1.4	Au
ssz135	2922 w/ MCP-476 25 mg/l	140	Air	1.8	Au
qcm0038	2922 w/ MCP-1408 25 mg/l	140	Air	1.7	Au
ssz136	2827 (old can)	140	Air	6.8	Au
ssz137	2827 w/ MCP-873 300 mg/l	140	Air	1.5	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
qcm0039	2827	140	Air		Au
qcm0040	2827 w/ MCP-1413B	140	Air	1.8	Au
ssz138	2827	140	Air	3.6	Au
qcm0041	2827	140	Air	4.4	Au
ssz139	2827	140	Air 20 psi (Heat-up with Nitrogen)	5.7	Au
ssz140	2827	140	Air 20 psi (Heat-up with Nitrogen)	5.7	Au
qcm0042	2926	140	Air	4.1	Au
ssz141	2827	160	Air 20 psi (Heat-up with Nitrogen)	8.2	Au
qcm0043	2827 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	1.4	Au
ssz142	2827	180	Air 20 psi (Heat-up with Nitrogen)	3.0	Au
qcm0044	2827 w/ 3F33 100 mg/l	140	Air	5.5	Au
ssz143	2827	170	Air 20 psi (Heat-up with Nitrogen)	6.3	Au
qcm0045	2827 w/ MCP-1413	140	Air	0.8	Au
ssz144	2827 w/ 8Q405 100 mg/l	140	Air	1.4	Au
qcm0046	2827 w/ Inhibitor A 100 mg/l	140	Air	3.3	Au
ssz145	2980 w/ MCP-1413 300 mg/l	140	Air	3.7	Au
qcm0047	2926 w/ MCP-1413 300 mg/l	140	Air	3.2	Au
ssz146	2827 w/ PL-1601 25 mg/l	140	Air	5.8	Au
qcm0048	2827 w/ PL-1602 25 mg/l	140	Air	12.1	Au
ssz147	2827 w/ PL-1517 25 mg/l	140	Air	12.3	Au
qcm0049	2827 w/ PL-1610 25 mg/l	140	Air	5.5	Au
ssz148	2980 w/ 8Q405 100 mg/l, BHT, 25 mg/l, and MDA 10 mg/l	140	Air	1.1	Au
ssz149	2936 w/ 8Q405 100 mg/l, BHT, 25 mg/l, and MDA 10 mg/l	140	Air	0.4	Au
ssz150	2926 w/ 8Q405 100 mg/l, BHT, 25 mg/l, and MDA 10 mg/l	140	Air	0.5	Au
qcm0051	2928 w/ 8Q405 100 mg/l, BHT, 25 mg/l, and MDA 10 mg/l	140	Air	2.7	Au
ssz151	2963 w/ 8Q405 100 mg/l, BHT, 25 mg/l, and MDA 10 mg/l	140	Air	0.7	Au
qcm0052	2959 w/ 8Q405 100 mg/l, BHT, 25 mg/l, and MDA 10 mg/l	140	Air	0.6	Au
qcm0053	2922 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	1.4	Au
ssz152	2934 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	4.5	Au
qcm0054	2985 w/ 8Q405 100 mg/l, BHT, 25 mg/l, and MDA 10 mg/l	140	Air	10.1	Au
ssz153	2827 w/ PL-1606 50 mg/l	140	Air	2.6	Au
qcm0055	2827 w/ PL-1607 50 mg/l	140	Air	2.9	Au
ssz154	2922 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	0.4	Au
qcm0056	2926 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	1.0	Au
ssz155	2934 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	0.6	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
qcm0057	2936 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	0.3	Au
ssz156	2980 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	0.9	Au
qcm0058	2985 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	2.0	Au
ssz157	2827 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	0.8	Au
ssz158	2963 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	1.0	Au
qcm0059	2928 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	3.3	Au
ssz159	2959 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	0.2	Au
ssz160	2827 w/ PL-1700 15 mg/l	140	Air	4.1	Au
qcm0060	2827 w/ 8Q400 10 mg/l	140	Air	6.7	Au
ssz161	2827 w/ PL-1642 50 mg/l	140	Air	1.9	Au
ssz162	2922	140	Air 10 psi (Heat-up with Nitrogen)	0.6	Au
qcm0061	2926 w/ BHT 25 mg/l, MCP-147B 100 mg/l, and MDA 10 mg/l	140	Air	1.1	Au
ssz163	2922	150	Air 10 psi (Heat-up with Nitrogen)	0.6	Au
qcm0062	2827 w/ BHT 25 mg/l, MCP-147B 100 mg/l, and MDA 10 mg/l	140	Air	1.1	Au
ssz164	2922	160	Air 10 psi (Heat-up with Nitrogen)	0.7	Au
qcm0063	2959 w/ BHT 25 mg/l, MCP-147B 100 mg/l, and MDA 10 mg/l	140	Air	0.5	Au
ssz165	2922	140	Air 10 psi (Heat-up with Nitrogen)	0.6	Au
ssz166	2827 w/ BHT 25 mg/l, 8Q405 100 mg/l, and MCP-477 300 mg/l	180	Air 20 psi (Heat-up with Nitrogen)	2.8	Au
qcm0064	2922 w/ Exxon #4 25 mg/l	140	Air	5.8	Au
ssz167	2827 w/ 8Q405 100 mg/l	180	Air 20 psi (Heat-up with Nitrogen)	4.1	Au
qcm0065	2922 w/ Exxon #8 25 mg/l	140	Air	6.7	Au
ssz168	2926	180	Air 20 psi (Heat-up with Nitrogen)	2.8	Au
qcm0066	2922 w/ Exxon #6 25 mg/l	140	Air	4.2	Au
qcm0067	2922 w/ Exxon #1 25 mg/l	140	Air	2.8	Au
ssz169	2922	140	Air 20 psi (Heat-up with Nitrogen)	2.0	Au
qcm0068	2922 w/ Exxon #11 25 mg/l	140	Air	1.5	Au
qcm0069	2922 w/ Exxon #13 25 mg/l	140	Air	1.4	Au
ssz170	2922 w/ Exxon #2 25 mg/l	140	Air	2.0	Au
ssz171	2922 w/ Exxon #5 25 mg/l	140	Air	3.3	Au
qcm0070	2922 w/ Exxon #10 25 mg/l	140	Air	4.0	Au
ssz172	2922 w/ Exxon #5 25 mg/l	140	Air	3.1	Au
qcm0071	2922 w/ Exxon #7 25 mg/l	140	Air	3.3	Au
ssz173	2827 w/ Exxon #14 100 mg/l	140	Air	7.0	Au
qcm0072	2827 w/ Exxon #15 100 mg/l	140	Air	3.7	Au
ssz174	2827 w/ Exxon #16 100 mg/l	140	Air	9.4	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
qcm0073	2827 w/ Exxon #17 100 mg/l	140	Air	4.4	Au
ssz175	2980	140	Air 10 psi (Heat-up with Nitrogen)	2.8	Au
qcm0074	2827	140	Air	5.7	Au
ssz176	2980	140	Air 20 psi (Heat-up with Nitrogen)	8.8	Au
qcm0075	2980	140	Nitrogen	0.3	Au
ssz177	2980	140	Air 5 psi (Heat-up with Nitrogen)	1.3	Au
qcm0076	2827	140	Air	5.0	Au
ssz178	2980	140	Air 30 psi (Heat-up with Nitrogen)	12.0	Au
qcm0077	2827 w/ 8Q405 100 mg/l	140	Air	0.6	Au
ssz179	2980	140	Air 15 psi (Heat-up with Nitrogen)	6.6	Au
qcm0078	2827 w/ 8Q405 100 mg/l	160	Air 20 psi (Heat-up with Nitrogen)	10.5	Au
ssz180	2827	140	Air 5 psi (Heat-up with Nitrogen)	3.7	Au
qcm0079	2827	140	Air 10 psi (Heat-up with Nitrogen)	2.6	Au
ssz181	3012	140	Air	9.3	Au
ssz182	2827 w/ Exxon #11 25 mg/l and Exxon #15 100 mg/l	140	Air	1.6	Au
qcm0080	2922 w/ Exxon #11 25 mg/l and Exxon #15 100 mg/l	140	Air	2.3	Au
qcm0081	2922 w/ Exxon #11 25 mg/l and Exxon #17 100 mg/l	140	Air	2.4	Au
ssz183	2827 w/ Exxon #11 25 mg/l and Exxon #17 100 mg/l	140	Air	1.5	Au
ssz184	3012 w/ BHT 25 mg/l and 8Q405 100 mg/l	140	Air	5.9	Au
qcm0082	2922 w/ Exxon #11 25 mg/l and 8Q405 100 mg/l	140	Air	1.9	Au
ssz185	2963 w/ 8Q405 100 mg/l and MDA 20 mg/l	140	Air	1.2	Au
ssz186	3012 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	2.1	Au
qcm0083	3012 w/ BHT 25 mg/l, 8Q405 100 mg/l, and MDA 10 mg/l	140	Air	5.9	Au
ssz187	3012 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	2.4	Au
ssz188	2980	140	Air 15 psi (Heat-up with Nitrogen)	3.5	Au
qcm0084	2980	160	Air 15 psi (Heat-up with Nitrogen)	3.0	Au
ssz189	2980	180	Air 15 psi (Heat-up with Nitrogen)	2.7	Au
qcm0085	2980	150	Air 15 psi (Heat-up with Nitrogen)	4.4	Au
ssz190	3013	140	Air	3.0	Au
qcm0086	3014	140	Air	1.6	Au
ssz191	3016	140	Air	1.1	Au
qcm0087	3017	140	Air	2.6	Au
ssz192	3013 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	2.9	Au
qcm0088	3014 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	1.5	Au
ssz193	3013 w/ MCP-147B 300 mg/l and BHT 25 mg/l	140	Air	0.6	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
qcm0089	3014 w/ MCP-147B 300 mg/l and BHT 25 mg/l	140	Air	0.9	Au
ssz194	3016 w/ MCP-147B 300 mg/l and BHT 25 mg/l	140	Air	1.0	Au
qcm0090	3017 w/ MCP-147B 300 mg/l and BHT 25 mg/l	140	Air	1.0	Au
ssz195	3013 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	3.7	Au
qcm0091	3014 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	3.2	Au
ssz196	3016 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	1.7	Au
qcm0092	3017 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	1.5	Au
ssz197	2827 w/ Isopar V (50/50)	140	Air	8.5	Au
ssz198	2827 w/ Exxsol D80 (50/50)	140	Air	1.4	Au
qcm0093	2827 w/ Exxsol D80 (10/90)	140	Air	0.7	Au
ssz199	Exxsol D80	140	Air	0.5	Au
qcm0094	2827 w/ Exxsol D80 (1/60)	140	Air	0.4	Au
ssz200	2827 w/ POSF-3022 100 mg/l	140	Air	2.1	Au
ssz201	2922 w/ POSF-3023 100 mg/l and 8Q405 100 mg/l	140	Air	0.3	Au
ssz202	2827 w/ POSF-3022 200 mg/l	140	Air	0.7	Au
qcm0096	3011	140	Air	8.3	Au
ssz203	2827 (2 ml) and Exxsol D-80 (59 ml)	140	Air	0.3	Au
qcm0097	3011 w/ BHT 25 mg/l and 8Q405 100 mg/l	140	Air	8.3	Au
ssz204	2827 (4 ml) and Exxsol D-80 (55 ml)	140	Air	0.9	Au
qcm0098	3011 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	2.7	Au
ssz205	2827 (6 ml) and Exxsol D-80 (55 ml)	140	Air	0.8	Au
qcm0099	2827 (8 ml) and Exxsol D-80 (52 ml)	140	Air	0.7	Au
ssz206	2985 w/ 8Q405 100 mg/l and Additive D 100 mg/l	140	Air	2.6	Au
qcm100	3011 w/ BHT 25 mg/l, 8Q405 100 mg/l, and MDA 10 mg/l	140	Air	1.0	Au
ssz207	2827 w/ 8Q405 200 mg/l	140	Air	2.8	Au
qcm101	2827 w/ 8Q405 400 mg/l	140	Air	0.4	Au
ssz208	2827 w/ 8Q405 400 mg/l (BAD)	140	Air	0.4	Au
qcm102	2926 w/ 8Q405 25 mg/l	140	Air	6.6	Au
ssz209	2827 w/ 8Q405 200 mg/l	140	Air	1.0	Au
qcm103	2926 w/ 8Q405 400 mg/l	140	Air	0.3	Au
ssz210	3034	140	Air	3.5	Au
qcm104	3035	140	Air	3.3	Au
ssz211	2827 w/ MCP-759 300 mg/l	140	Air	1.9	Au
qcm105	2827 w/ MCP-867 300 mg/l	140	Air	2.0	Au
ssz212	2827 w/ MCP-753 300 mg/l	140	Air	3.1	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours (μg/cm^2)	Electrode Material
qcm106	2827 w/ MCP-880 300 mg/l	140	Air	2.0	Au
ssz213	2827 w/ MCP-750 300 mg/l	140	Air	5.7	Au
qcm107	2827 w/ MCP-902 300 mg/l	140	Air	2.9	Au
ssz214	2827 w/ MCP-758 300 mg/l	140	Air	2.7	Au
qcm108	2827 w/ MCP-1395 300 mg/l	140	Air	0.4	Au
ssz215	2827 w/ Ferrox 530 160 mg/l	140	Air	5.4	Au
qcm109	2827 w/ MCP-751 300 mg/l	140	Air	13.3	Au
ssz216	2926 w/ 8Q405 50 mg/l	140	Air	3.8	Au
qcm110	2926 w/ 8Q405 200 mg/l	140	Air	0.8	Au
qcm111	2926 w/ 8Q405 100 mg/l and 3F29 15 mg/l	140	Air	2.5	Au
ssz217	2926 w/ 8Q405 100 mg/l and 3F29 30 mg/l	140	Air	2.2	Au
ssz218	2926 w/ 8Q405 100 mg/l and 3F29 60 mg/l	140	Air	1.1	Au
qcm113	2926 w/ 8Q405 100 mg/l and 327S9D 30 mg/l	140	Air	4.0	Au
ssz219	2926 w/ 8Q405 100 mg/l and 327S9D 15 mg/l	140	Air	4.6	Au
qcm114	2926 w/ 8Q405 100 mg/l and 327S9D 60 mg/l	140	Air	7.8	Au
ssz220	2922 w/ BHT 25 mg/l and MCP-1395 300 mg/l	140	Air	0.2	Au
qcm115	2926 w/ BHT 25 mg/l and MCP-1395 300 mg/l	140	Air	1.5	Au
qcm116	3034 w/ BHT 25 mg/l and 8Q405 100 mg/l	140	Air	1.8	Au
ssz221	2985 w/ BHT 25 mg/l and MCP-1395 300 mg/l	140	Air	3.4	Au
ssz222	2926 w/ BHT 50 mg/l and 8Q405 100 mg/l	140	Air	4.4	Au
qcm117	2827 from EDTST	140	Air	3.5	Au
ssz223	2926 w/ BHT 15 mg/l and 8Q405 100 mg/l	140	Air	1.2	Au
qcm118	2980 from RSFSS flight idle recirc	140	Air	9.6	Au
qcm119	2827 w/ SDAD-722-2	140	Air	1.5	Au
qcm120	2827 w/ SDAD-722-4	140	Air	6.1	Au
ssz224	2827 w/ SDAD-722-1	140	Air	3.5	Au
ssz225	2980 w/ BHT 25 mg/l, MCP-147B 300 mg/l, and MDA 10 mg/l	140	Air	0.1	Au
ssz226	2926 w/ 8Q405 100 mg/l and Inhibitor A 30 mg/l	140	Air	1.4	Au
qcm121	3056	140	Air	2.3	Au
ssz227	3056 w/ BHT 25 mg/l and MCP-147B 300 mg/l	140	Air	0.6	Au
qcm122	3056 w/ BHT 25 mg/l and 8Q405 100 mg/l	140	Air	0.4	Au
ssz228	2926 w/ 8Q405 100 mg/l and Inhibitor A 7.5 mg/l	140	Air	4.1	Au
qcm123	2926 w/ 8Q405 100 mg/l and Inhibitor A 15 mg/l	140	Air	1.4	Au
ssz229	2827 w/ MCP-147B 300 mg/l	140	Air	0.6	Au
qcm124	2827 w/ MCP-147B 150 mg/l	140	Air	1.1	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
ssz230	2827 w/ MCP-147B 75 mg/l	140	Air	2.5	Au
qcm125	2827 w/ MCP-147B 30 mg/l	140	Air	4.7	Au
ssz231	2926 w/ MCP-147B 150 mg/l	140	Air	1.6	Au
qcm126	2926 w/ MCP-147B 75 mg/l	140	Air	3.0	Au
ssz232	3056 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.2	Au
qcm127	3056 w/ MCP-147B 300 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.6	Au
ssz233	2827 H2O/KOH extracted	140	Air	5.3	Au
ssz234	2926 w/ MCP-147B 300 mg/l	140	Air	0.6	Au
ssz235	2827 w/ 3275059B 100 mg/l	140	Air	8.1	Au
qcm128	2926 w/ MCP-147B 30 mg/l	140	Air	3.9	Au
ssz236	2827 w/ 3275059C 100 mg/l	140	Air	4.1	Au
qcm129	2980 w/ 8Q405 10000 mg/l, BHT 2500 mg/l, and MDA 100 mg/l	140	Air	0.3	Au
ssz237	2990	140	Air	8.3	Au
qcm130	2991	140	Air	0.7	Au
ssz238	2926 w/ MCP-147B 600 mg/l	140	Air	0.6	Au
qcm131	2827 w/ MCP-147B 600 mg/l	140	Air	1.0	Au
ssz239	2827 w/ SDA-722-3	140	Air	1.3	Au
ssz240	2990	140	Air	11.5	Au
qcm132	2991	140	Air	7.3	Au
ssz241	2926 w/ MCP-147B 150 mg/l and BHT 50 mg/l	140	Air	1.5	Au
qcm133	2926 w/ MCP-147B 150 mg/l and BHT 25 mg/l	140	Air	1.6	Au
ssz242	2992	140	Air	1.9	Au
qcm134	2926 w/ MCP-147B 150 mg/l and BHT 15 mg/l	140	Air	1.3	Au
ssz243	2990 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	5.4	Au
qcm135	2991 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	6.9	Au
ssz244	2993	140	Air	5.2	Au
qcm136	2926 w/ MCP-147B 150 mg/l and BHT 100 mg/l	140	Air	1.7	Au
ssz245	2827 (dirty crystal)	140	Air	4.0	Au
qcm137	2827	140	Air	6.6	Au
ssz246	2827	140	Air	17.9	Ag
ssz247	2827 (Al crystal)	140	Air	3.7	Al
qcm138	2827	140	Air	3.8	Pt
ssz248	2827 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.6	Al
ssz249	2827 w/ MCP-147B 300 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.7	Al
ssz250	2827 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	3.5	Pt

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours (μg/cm^2)	Electrode Material
qcm140	2827 w/ MCP-147B 300 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.8	Pt
ssz251	2827 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Nitrogen	26.2	Ag
qcm141	2827	140	Helium	30.2	Ag
ssz252	2747	140	Nitrogen	1.1	Ag
qcm142	2747	140	Air	3.1	Pt
ssz253	2922	140	Nitrogen	0.6	Ag
qcm143	2747	140	Air	0.5	Al
ssz254	2980	140	Nitrogen	0.8	Ag
ssz255	2994	140	Air	5.5	Au
qcm145	2999	140	Air	4.4	Au
ssz256	2995	140	Air	1.4	Au
qcm146	3001	140	Air	2.7	Au
ssz257	3000	140	Air	5.7	Au
qcm147	3002	140	Air	8.8	Au
ssz258	2827 w/ 3057 (Texaco) 442 mg/l	140	Air	0.7	Au
qcm148	2827 w/ 3058 (Texaco) 174 mg/l	140	Air	4.8	Au
ssz259	3020	140	Air	1.1	Au
qcm149	3019	140	Air	2.1	Au
ssz260	3030	140	Air	4.0	Au
qcm150	3059	140	Air	4.5	Au
ssz261	3060	140	Air	2.6	Au
qcm151	3036	140	Air	2.3	Au
ssz262	3061	140	Air	4.0	Au
qcm152	3062	140	Air	4.8	Au
ssz263	3047	140	Air	2.2	Au
qcm153	3031	140	Air	5.7	Au
ssz264	3029	140	Air	4.8	Au
qcm154	3049	140	Air	7.3	Au
ssz265	3047 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	3.6	Au
qcm155	3049 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	4.6	Au
ssz266	3030 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	2.6	Au
qcm156	3036 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	1.2	Au
ssz267	3019 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	5.7	Au
qcm157	3059 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	6.5	Au
ssz268	3019	140	Air 15 psi (Heat-up with Nitrogen)	2.9	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
qcm158	3029 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	5.5	Au
ssz269	2990 w/ MCP-147B 300 mg/l and BHT 25 mg/l	140	Air	2.8	Au
qcm159	2991 w/ MCP-147B 300 mg/l and BHT 25 mg/l	140	Air	3.7	Au
ssz270	2827 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	1.5	Au
qcm160	2999 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	3.9	Au
ssz271	2980 w/ 8Q405 100 mg/l (Old Additive)	140	Air	2.2	Au
qcm161	2980 w/ 8Q405 100 mg/l (New Additive)	140	Air	7.3	Au
ssz273	2827	140	Air	6.7	Au
qcm163	2827 w/ 8Q405 100 mg/l (new, new)	140	Air	3.1	Au
ssz274	2827 w/ 8Q405 100 mg/l (new)	140	Air	2.8	Au
ssz275	2827 (from drum)	140	Air	3.2	Au
qcm164	2827 (from 5 gal can)	140	Air	4.8	Au
ssz276	2827 (from drum) w/ 8Q405 100 mg/l (new)	140	Air	2.4	Au
qcm165	2827 (from 5 gal can) w/ 8Q405 100 mg/l (new)	140	Air	2.7	Au
ssz277	2827 (drum) w/ 8Q405 100 mg/l (new, new)	140	Air	2.2	Au
qcm166	2827 (drum) w/ 8Q405/BHT mix 170 mg/l (dirty engine test)	140	Air	3.9	Au
ssz278	2980 w/ 50 ppb copper	140	Air	9.4	Au
qcm167	2980 w/ 10 ppb copper	140	Air	12.0	Au
ssz279	2990 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	2.7	Au
qcm168	2991 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	1.2	Au
ssz280	3037	140	Air	5.1	Au
qcm169	3048	140	Air	7.9	Au
ssz281	3037 w/ MCP-147B 300 mg/l and BHT 25 mg/l	140	Air	1.2	Au
qcm171	2827 w/ MCP-1309 300 mg/l	140	Air	2.0	Au
ssz282	3048 w/ MCP-147B 300 mg/l and BHT 25 mg/l	140	Air	1.2	Au
ssz283	3000 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	4.8	Au
qcm172	3001 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	4.9	Au
ssz284	3000 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	2.0	Au
qcm173	3001 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	1.1	Au
ssz285	3059 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	1.5	Au
ssz286	2827 w/ MCP-1521 300 mg/l	140	Air	1.3	Au
ssz287	2980 w/ Copper 40 ppb	140	Air	28.2	Au
ssz288	2980 w/ Copper 20 ppb	140	Air	2.6	Au
qcm174	3049 w/ 8Q405 100 mg/l, BHT 25 mg/l and MDA 10 mg/l	140	Air	2.2	Au
qcm175	2985 w/ MCP-1309 300 mg/l and BHT 25 mg/l	140	Air	2.0	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours (μg/cm^2)	Electrode Material
ssz289	2827 w/ PL-1712 308 mg/l	140	Air	2.9	Au
pz001	2827	140	Air	5.0	Au
ssz290	2827 w/ PL-1708 112.5 mg/l	140	Air	1.8	Au
qcm176	2980 w/ MCP-1521 300 mg/l	140	Air	3.0	Au
pz002	2827 (5-gallon can)	140	Air	3.5	Au
pz003	2827 (5-gallon can) 30 ml w/ Exxsol D-80 30 ml	140	Helium	37.8	Ag
ssz291	2980 w/ MCP-1309 300 mg/l	140	Air	3.1	Au
qcm177	2827 w/ PL-1715 135 mg/l	140	Air	1.9	Au
pz004	2827 (5-gallon can) 5 ml w/ Exxsol D-80 55 ml	140	Helium	15.8	Ag
ssz292	2827 w/ PL-1709 392 mg/l	140	Air	3.1	Au
qcm178	2827 w/ PL-1710 87 mg/l	140	Air	2.3	Au
pz005	3002 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	8.3	Au
qcm179	2994 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	2.7	Au
ssz293	2993 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	0.3	Au
ssz294	2827 w/ PL-1707 125 mg/l	140	Air	3.3	Au
qcm180	2827 w/ PL-1711 235 mg/l	140	Air	2.0	Au
ssz295	2993 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.22	Au
pz006	2827 from 5-gallon can	140	Air 15 psi (Heat-up with Helium)	6.9	Au
pz007	2827	140	Air 5 psi (Heat-up with He)	1.8	Au
qcm181	3047 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.6	Au
ssz296	2995 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	0.7	Au
ssz298	2922	140	Air	1.5	Au
ssz297	2922 w/ phenol 112 mg/l	140	Air	0.9	Au
pz008	2827	140	Air 25 psi (Heat-up with He)	6.6	Au
qcm182	3037 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	4.7	Au
ssz299	3019 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	6.2	Au
qcm183	3048 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	4.7	Au
pz009	2827	140	Air 15 psi (Heat-up with He)	4.7	Au
ssz300	3036 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.3	Au
qcm184	3049 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	1.2	Au
ssz301	3037 w/ phenol 90 ppm	140	Air	5.3	Au
qcm185	3020 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	3.2	Au
pz010	2827	140	Air 30 psi (Heat-up with He)	6.9	Au
pz011	2827	140	Air 10 psi (Heat-up with He)	3.0	Au
qcm186	3062 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	2.6	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours (μg/cm²)	Electrode Material
ssz302	3061 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	5.5	Au
ssz303	2992 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	0.9	Au
pz012	2827	140	Air 20 psi (Heat-up with He)	6.4	Au
qcm187	3031 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	6.6	Au
pz013	2827 w/ 8Q405-1671 100 mg/l	140	Air	1.3	Au
qcm188	2827 w/ 8Q405-1621 100mg/l	140	Air	2.4	Au
ssz304	2827 w/ 8Q405-1591 100 mg/l	140	Air	1.6	Au
ssz305	2827 w/ 8Q405-1571 100 mg/l	140	Air	2.1	Au
pz014	2827 w/ 8Q405-1651 100 mg/l	140	Air	1.3	Au
qcm189	2827 w/ 8Q405-1641 100 mg/l	140	Air	2.4	Au
ssz306	3002 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	6.6	Au
qcm190	3030 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.3	Au
pz015	3031 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.2	Au
ssz307	2995 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	1.0	Au
pz016	2992 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.9	Au
qcm191	2994 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.3	Au
qcm192	3048 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.9	Au
pz017	3062 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.3	Au
qcm193	3061 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.4	Au
pz018	2827 H2O and KOH Extracted	140	Air	5.1	Au
qcm194	2999 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.2	Au
ssz308	3059 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	5.1	Au
ssz309	2959 SPE Extracted	140	Air	2.0	Au
pz020	3037 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 25 mg/l	140	Air	0.5	Au
ssz310	2827 w/ 8Q406 125 mg/l	140	Air	1.4	Au
pz021	3029 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.6	Au
ssz311	2827 w/ 3091 27 ml/l	140	Air	0.8	Au
qcm195	2827 w/ 3094 27 ml/l	140	Air	1.1	Au
pz022	2922 w/ VX-4447 25 mg/l	140	Air	2.1	Au
ssz312	2926 w/ 8Q406 125 mg/l	140	Air	4.4	Au
qcm196	2980 w/ 8Q406 125 mg/l	140	Air	5.1	Au
pz023	3020 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	0.5	Au
ssz313	2827 w/ 8Q405-1591 100 mg/l and BHT 25 mg/l	140	Air	1.2	Au
pz024	2980 w/ 8Q405-1591 100 mg/l and BHT 25 mg/l	140	Air	1.0	Au
qcm197	2926 w/ 8Q405-1591 100 mg/l and BHT 25 mg/l	140	Air	3.4	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours (µg/cm^2)	Electrode Material
qcm198	2827 w/ 3095 27 ml/l	140	Air	0.5	Au
pz025	2827 w/ 3096 27 ml/l	140	Air	0.3	Au
ssz314	2827 w/ 3090 27 ml/l	140	Air	1.3	Au
qcm199	2959	140	Air	4.4	Au
pz026	3037 SPE	140	Air	7.7	Au
ssz315	2827 w/ 3092 27 ml/l	140	Air	1.2	Au
qcm200	2827 w/ 3093 27 ml/l	140	Air	1.3	Au
pz027	2827 w/ 3097 27 ml/l	140	Air	6.8	Au
ssz316	2995 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	1.1	Au
ssz317	2827 w/ PL-1707 125 mg/l	140	Air	2.5	Au
qcm201	2827 w/ PL-1709 392 mg/l	140	Air	1.3	Au
pz028	2827 w/ PL-1710 87 mg/l	140	Air	0.3	Au
ssz318	3098	140	Air	1.2	Au
qcm202	3099	140	Air	1.4	Au
pz029	3100	140	Air	1.6	Au
qcm203	3098 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	0.5	Au
pz030	3098 w/ 8Q405 100 mg/l and 8Q203 70 mg/l	140	Air	0.5	Au
qcm204	2922 w/ CAO-5 25 mg/l	140	Air	3.3	Au
pz031	2922 w/ PRODOX 3114 25 mg/l	140	Air	4.1	Au
qcm205	2827 w/ IFLC 1002 125 mg/l	140	Air	2.6	Au
pz032	2980 w/ PL-1710 87 mg/l	140	Air	1.9	Au
ssz319	2827	140	Air	4.3	Au
ssz320	2827 after clay treatment	140	Air	1.3	Au
qcm206	2926 w/ PL-1710 87 mg/l	140	Air	7.5	Au
pz033	2985 w/ PL-1710 87 mg/l	140	Air	13.4	Au
ssz321	2827 after silica gel extraction	140	Air	2.9	Au
qcm207	2959 after basic water extraction	140	Air	13.1	Au
pz034	2926 w/ MCP-1521 150 mg/l	140	Air	6.0	Au
ssz322	2926 w/ PL-1709 392 mg/l	140	Air	5.1	Au
qcm208	2980 w/ MCP-1521 150 mg/l	140	Air	5.0	Au
pz035	2926	140	Air	5.1	Au
ssz323	2747 after basic water treatment	140	Air	1.1	Au
ssz324	2963	140	Air	13.1	Au
pz036	2962	140	Air	6.5	Au
ssz325	2963 w/ 8Q406 125 mg/l	140	Air	4.5	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
qcm209	2962 w/ 8Q406 125 mg/l and MDA 2 mg/l	140	Air	5.2	Au
pz037	2962 w/ 8Q406 125 mg/l	140	Air	3.8	Au
qcm210	2962 w/ 8Q406 125 mg/l and MDA 5 mg/l	140	Air	4.3	Au
pz038	2963 w/ 8Q406 125 mg/l and MDA 5 mg/l	140	Air	0.4	Au
ssz326	2963 w/ 8Q406 125 mg/l and MDA 2 mg/l	140	Air	0.8	Au
qcm211	2963 w/ 8Q406 125 mg/l and MDA 10 mg/l	140	Air	1.8	Au
pz039	2962 w/ 8Q406 125 mg/l and MDA 10 mg/l	140	Air	0.1	Au
ssz327	2827 w/ 3111 144 mg/l	140	Air	0.7	Au
qcm212	2827 w/ 3112 135 mg/l	140	Air	1.0	Au
pz040	2827 w/ 3113 160 mg/l	140	Air	0.1	Au
ssz328	2926 w/ C-13 labelled phenol 200 mg/l	140	Air	5.1	Au
qcm213	2827 w/ 3114 160 mg/l	140	Air	1.1	Au
pz041	2827 w/ 3115 160 mg/l	140	Air	0.1	Au
ssz329	2827 w/ 3115 160 mg/l	140	Air	0.6	Au
qcm214	2827 w/ 3116 145 mg/l	140	Air	1.1	Au
pz042	2827 w/ 3117 135 mg/l	140	Air	0.5	Au
pz043	2827 w/ 3113 160 mg/l	140	Air	0.1	Au
pz044	2827	140	Air	3.8	Au
ssz330	2827 w/ MCP-1571 150 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.7	Au
qcm215	2980 w/ MCP-1571 150 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	1.1	Au
pz045	2926 w/ MCP-1571 150 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	1.3	Au
ssz337	2926	140	Air 4.9 psi (Heat-up with Nitrogen)	0.6	Au
qcm220	3110	140	Air	5.7	Au
ssz338	3083 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	0.7	Au
qcm221	3098 w/ 8Q405 and 8Q203 (Kelly flight test)	140	Air	0.5	Au
pz046	3082	140	Air	12.7	Au
ssz339	3108	140	Air	7.2	Au
ssz340	3082 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	8.0	Au
qcm222	3109	140	Air	2.8	Au
pz048	2827 w/ triphenylphosphine 142 mg/60 ml	140	Air	0.0	Au
ssz341	3108 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	3.9	Au
qcm224	3109 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	0.3	Au
ssz342	3102 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	9.2	Au
ssz343	3109 w/ 8Q405 100 mg/l, BHT 25 mg/l, and 2 mg/l	140	Air	0.4	Au
pz047	2827	140	Air	5.7	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
qcm226	3110 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.3	Au
ssz344	3082 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.5	Au
ssz272	3285	140	Air	9.7	Au
ssz331	3084 w/ JP-8 additives	140	Air	7.1	Au
ssz332	3084 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	5.6	Au
ssz333	2926	140	Air 14.2 psi (Heat-up with Nitrogen)	2.9	Au
ssz334	2926	140	Air 9.4 psi (Heat-up with Nitrogen)	1.4	Au
ssz335	2926	140	Air 18.5 psi (Heat-up with Nitrogen)	7.2	Au
ssz336	2926	140	Air 27.9 psi (Heat-up with Nitrogen)	7.8	Au
qcm139	2827 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 10 mg/l	140	Air	5.5	Pt
qcm144	2747	140	Air	0.6	Au
qcm159	2991 w/ MCP-147B 300 mg/l and BHT 25 mg/l	140	Air	3.7	Au
qcm162	2980 w/ 8Q405 100 mg/l (new, new additive)	140	Air	6.1	Au
qcm216	3084	140	Air	19.2	Au
qcm217	3084 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	5.1	Au
qcm218	3083	140	Air	4.4	Au
qcm219	3102	140	Air	8.7	Au
qcm228	3108 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.6	Au
qcm229	3110 w/ 8Q405 100 mg/l and BHT 25 mg/l	140	Air	0.8	Au
ssz345	3083 w/ 8Q405 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	3.7	Au
pz049	2827 w/ triphenylphospine 142 mg/60 ml	100	Air	0.0	Au
ssz346	Exxsol D-80 w/ BHT 25 mg/l	140	Air 13.7 psi (Heat-up with Nitrogen)	0.3	Au
qcm230	3102 w/ 8Q405 100 mg/l, BHT 25 mg/l and MDA 2 mg/l	140	Air	2.0	Au
pz052	Hexadecane	100	Air	0.0	Au
pz051	Hexadecane	140	Air	0.2	Au
pz053	Hexadecane	120	Air	0.1	Au
ssz347	Exxsol D-80 w/ BHT 25 mg/l	140	Air 25 psi (Heat-up with Nitrogen)	0.6	Au
ssz348	Exxsol D-80 w/ BHT 25 mg/l	140	Air 5.2 psi (Heat-up with Nitrogen)	0.2	Au
ssz349	Exxsol D-80 w/ BHT 25 mg/l	140	Air 10.1 psi (Heat-up with Nitrogen)	0.2	Au
qcm231	2827 w/ MCP-147B 150 mg/l, BHT 25 mg/l and MDA 2 mg/l	140	Air	0.8	Au
ssz350	Exxsol D-80 w/ BHT 25 mg/l	140	Air 36.3 psi (Heat-up with Nitrogen)	0.4	Au
qcm232	2926 w/ MCP-147B 150 mg/l, BHT 25 mg/l and MDA 2 mg/l	140	Air	1.0	Au
pz054	Hexadecane w/ triphenylphosphine 2430 mg/l	120	Air	0.0	Au
ssz352	Exxsol D-80 w/ BHT 25 mg/l	140	Air 20.0 psi (Heat-up with Nitrogen)	0.1	Au
ssz351	Exxsol D-80 w/ BHT 25 mg/l	140	Air 15.2 psi (Heat-up with Nitrogen)	0.3	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
pz055	Hexadecane w/ triphenylphosphine 0.972 g/l	120	Air	0.0	Au
pz056	Hexadecane with 0.972 g/l triphenylphosphine	100	Air	0.0	Au
ssz353	2980 w/ MCP-147B 150 mg/l, BHT 25 mg/l and MDA 2 mg/l	140	Air	0.6	Au
ssz354	3084 w/ 8Q405 100 mg/l, BHT 25 mg/l, and JP-8 additives (P.H.)	140	Air	4.6	Au
qcm233	3084 w/ JP-8 additives (Parker Hannifin)	140	Air	3.9	Au
ssz355	Dodecane w/ 3-methylthiophene 81 mg/l	140	Air	0.9	Ag
pz057	Hexadecane	120	Air	0.0	Au
ssz356	Dodecane w/ diphenylsulfide 81 mg/l	140	Air	0.9	Ag
qcm234	Dodecane w/ 1-hexanethiol 67 mg/l	140	Helium	0.4	Ag
ssz357	3084	140	Air	14.9	Au
ssz358	Dodecane w/ 3,4 dimethylthiophenol 82 mg/l	140	Nitrogen	0.5	Ag
qcm235	Dodecane w/ benzyldisulfide 100 mg/l	140	Helium	0.8	Au
ssz361	2747 w/ 2827 SPE extract and sulfur compounds 1 ml	140	Nitrogen	1.5	Ag
ssz360	2747 w/ 1-hexanethiol 337 mg/l	140	Nitrogen	0.6	Ag
ssz362	2827 SPE extracted	140	Nitrogen	37.7	Ag
qcm237	2747 with 2827 SPE extract	140	Helium	1.5	Ag
ssz363	2747 (used Pt crystal)	140	Air	1.0	Pt
qcm238	2980 w/ 3096 27 ml/l	140	Air	0.7	Au
ssz364	2926 w/ 3096 27 m/l/	140	Air	0.5	Au
qcm239	2747	140	Air	1.0	Au
ssz365	2980 w/ 3096 5 ml/l	140	Air	1.5	Au
qcm240	2926 w/ 3096 5 ml/l	140	Air	1.2	Au
ssz366	2747	140	Air	1.1	Pt
qcm241	2827 30 ml and 2747 30 ml	140	Air	3.1	Au
ssz367	2980 w/ 3096 10 ml/l	140	Air	1.2	Au
qcm242	2926 w/ 3096 10 ml/l	140	Air	0.6	Au
ssz369	2926 w/ 3096 20 ml/l	140	Air	0.5	Au
ssz368	2926 w/ tetrahydroquinoline 500 ppm	140	Air	8.4	Au
qcm244	2922	140	Air	2.9	Au
ssz371	2926 w/ benzyl alcohol 500 ppm	140	Air	2.2	Au
ssz370	2827	140	Air	2.8	Au
qcm245	2827	140	Air	3.6	Au
ssz372	2827 recirculated	140	Air	5.4	Au
qcm246	2827 recirculated	140	Air	4.0	Au
ssz373	2827	140	Air	6.6	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours (μg/cm^2)	Electrode Material
qcm247	2827	140	Air	3.0	Au
ssz374	2827	140	Air	4.2	Au
ssz375	2827 recirculated	140	Air	5.2	Au
qcm248	3119	140	Air	11.4	Au
ssz376	2827 recirculated twice	140	Air	3.2	Au
qcm249	3119 recirculated	140	Air	8.2	Au
qcm250	3123	140	Air	1.4	Au
ssz377	3122	140	Air	4.3	Au
ssz380	2922 w/ TBHQ 25 mg/l	140	Air	4.1	Au
ssz381	2922 w/ PL-1694 25 mg/l	140	Air	11.3	Au
qcm252	2922	140	Air	2.6	Au
ssz382	2922 w/ VX-4447 25 mg/l	140	Air	3.8	Au
ssz383	2922	140	Air	4.4	Au
ssz384	2922 w/ 3023 25 mg/l	140	Air	3.3	Au
ssz385	2922 w/ 2927 25 mg/l	140	Air	6.6	Au
ssz386	2922 w/ 3104 25 mg/l	140	Air	4.2	Au
qcm253	2827 w/ 3096 10 ml/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	1.0	Au
qcm254	2926 w/ 3096 10 ml/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.5	Au
ssz387	2922 w/ BHT 25 mg/l	140	Air	3.7	Au
ssz388	2922 w/ 3105 25 mg/l	140	Air	4.7	Au
qcm255	3084 w/ 3096 10 ml/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	1.3	Au
ssz389	2922 w/ 3106 25 mg/l	140	Air	3.5	Au
ssz390	2922 w/ 3079 25 mg/l	140	Air	4.5	Au
ssz391	2922 w/ 3080 25 mg/l	140	Air	5.5	Au
qcm256	3084 w/ BzOH 500 ppm	140	Air	6.5	Au
ssz392	2922 w/ PL-1694 5 mg/l	140	Air	2.5	Au
ssz394	3136 (Asian Jet A-1)	140	Air	3.1	Au
qcm257	2827	140	Air	4.5	Au
ssz393	2922	140	Air	2.4	Au
ssz395	Dodecane w/ 10 mg/l elemental sulfur	140	Air	29.0	Au
ssz396	2922 w/ BHT 25 mg/l and MDA 5.7 mg/l	140	Air	4.2	Au
qcm259	2827 Mobile Blend #2 437.5 mg/l	140	Air	0.8	Au
ssz398	Dodecane with 1 mg/l elemental sulfur	140	Nitrogen	14.3	Ag
qcm261	2827 w/ POSF-3124 160 mg/l	140	Air	0.8	Au
ssz399	Dodecane w/ elemental S 0.1 mg/l	140	Nitrogen	13.6	Ag

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
qcm260	2827 w/ Mobile Blend #3 500 mg/l	140	Air	0.7	Au
ssz397	2922 w/ MDA 5.7 mg/l	140	Air	3.1	Au
qcm262	2827 w/ POSF-3125 160 mg/l	140	Air	2.1	Au
ssz401	2827	140	Air	7.0	Au
qcm263	2827 w/ POSF-3126 160 mg/l	140	Air	1.0	Au
ssz402	2827 w/ POSF-3126 160 mg/l	140	Air	2.9	Au
qcm264	2827 w/ POSF-3127 160 mg/l	140	Air	0.9	Au
ssz400	2827 w/ MCP-147B 150 mg/l	140	Air	2.6	Au
ssz403	2818	140	Air	1.7	Au
qcm265	2827 w/ POSF-3128 160 mg/l	140	Air	1.1	Au
ssz404	2827	140	Air	6.8	Au
qcm266	2827 w/ POSF-3129 160 mg/l	140	Air	0.8	Au
qcm267	2827	140	Air	3.1	Au
qcm268	2827	140	Air	3.3	Au
ssz405	2827	140	Air	6.8	Au
ssz406	2827	140	Air	4.5	Au
qcm269	2827 w/ MCP-147B 150 mg/l	140	Air	1.7	Au
ssz407	2827	140	Air	5.3	Au
qcm270	2827	140	Air	5.4	Au
qcm271	2747	140	Air	0.7	Au
ssz408	3134	140	Air	1.2	Au
ssz409	3135	140	Air	1.6	Au
pz060	2827	140	Air	4.4	Au
pz061	2827 w/ MCP-147B 150 mg/l	140	Air	0.8	Au
ssz410	3132 JP-8+100 (after filter)	140	Air	1.9	Au
ssz411	3131 JP-8+100 (before filter)	140	Air	1.2	Au
pz063	2747	140	Air	1.3	Au
ssz412	2926	140	Air	4.0	Au
pz064	2747	140	Air	0.7	Au
ssz413	2926 w/ MCP-147B 150 mg/l	140	Air	1.0	Au
ssz414	2926	160	Air	1.0	Au
pz065	2827	160	Air	4.5	Au
pz066	2827	160	Air	4.7	Au
pz067	2827 w/ MCP-147B 150 mg/l	160	Air	3.4	Au
ssz415	2926	160	Air	1.8	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
ssz416	2926 w/ MCP-147B 150 mg/l	160	Air	0.6	Au
pz068	2827 w/ MCP-147B 150 mg/l	160	Air	4.3	Au
ssz417	2926 w/ MCP-147B 150 mg/l	160	Air	0.6	Au
ssz160	2827 w/ PL-1700 15 mg/l	140	Air	4.1	Au
pz069	2827 w/ MDA 2 mg/l	160	Air	6.6	Au
ssz418	2926 w/ MDA 2 mg/l	160	Air	2.5	Au
pz070	2827 w/ 8Q406 125 mg/l	160	Air	8.5	Au
ssz419	2926 w/ 8Q406 125 mg/l	160	Air	1.7	Au
ssz420	2926 w/ 8Q406 125 mg/l	140	Air	2.5	Au
pz071	2926 w/ 8Q406 125 mg/l	140	Air	0.7	Au
pz072	2827 w/ MDA 2 mg/l	140	Air	6.9	Au
ssz421	2926 w/ MDA 2 mg/l	140	Air	2.9	Au
pz073	2827	140	Air 15 psi (Heat-up with Nitrogen)	6.4	Au
ssz422	2926	140	Air 15 psi (Heat-up with Nitrogen)	2.4	Au
pz074	2827 w/ 3096 10 ml/l, BHT 25 mg/l, and MDA 2 mg/l	160	Air 15 psi (Heat-up with Nitrogen)	1.7	Au
ssz423	2926 w/ 3096 10 ml/l, BHT 25 mg/l, and MDA 2 mg/l	160	Air 15 psi (Heat-up with Nitrogen)	1.8	Au
pz075	2827 w/ 3096 10 ml/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air 15 psi (Heat-up with Nitrogen)	0.5	Au
ssz424	2926 w/ 3096 10 ml/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air 15 psi (Heat-up with Nitrogen)	0.4	Au
ssz425	2926 w/ 3096 10 ml/l, BHT 25 mg/l, and MDA 2 mg/l	170	Air 15 psi (Heat-up with Nitrogen)	2.0	Au
pz076	2827 w/ 3096 10 ml/l, BHT 25 mg/l, and MDA 2 mg/l	170	Air 15 psi (Heat-up with Nitrogen)	1.9	Au
pz077	2827 w/ 3096 10 ml/l, BHT 25 mg/L, and MDA 2 mg/l	150	Air 15 psi (Heat-up with Nitrogen)	1.3	Au
ssz426	2926 w/ 3096 10 ml/l, BHT 25 mg/l, and MDA 2 mg/l	150	Air 15 psi (Heat-up with Nitrogen)	0.7	Au
pz078	2827	170	Air 15 psi (Heat-up with Nitrogen)	2.6	Au
ssz427	2926	170	Air 15 psi (Heat-up with Nitrogen)	1.5	Au
ssz428	3084	140	Air 15 psi (Heat-up with Nitrogen)	10.6	Au
pz079	3119	140	Air 15 psi (Heat-up with Nitrogen)	7.0	Au
ssz429	3084	140	Air	24.8	Au
pz080	3119	140	Air	9.3	Au
ssz430	3084 w/ 8Q406 125 mg/l	140	Air	6.5	Au
pz081	3119 w/ 8Q406 125 mg/l	140	Air	7.8	Au
ssz431	3084 w/ MDA 5.8 mg/l	140	Air	1.8	Au
pz082	3119 w/ MDA 5.8 mg/l	140	Air	12.8	Au
ssz432	3084 w/ 8Q406 125 mg/l and MDA 5.8 mg/l	140	Air	0.2	Au
pz083	3119 w/ 8Q406 125 mg/l and MDA 5.8 mg/l	140	Air	0.5	Au
ssz433	3084 w/ BHT 24 mg/l and MDA 5.8 mg/l	140	Air	1.3	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
pz084	3119 w/ BHT 24 mg/l and MDA 5.8 mg/l	140	Air	1.3	Au
pz085	3119 w/ BHT 24 mg/l	140	Air	26.8	Au
ssz434	3084 w/ BHT 24 mg/l	140	Air	5.3	Au
pz086	3145	140	Air	7.1	Au
ssz435	3139	140	Air	0.7	Au
pz087	3145	140	Air	6.4	Au
ssz436	3139 w/ BHT 24 mg/l	140	Air	0.4	Au
ssz437	3139 w/ MDA 5.8 mg/l	140	Air	0.8	Au
pz088	3145 w/ 8Q406 125 mg/l	140	Air	2.8	Au
ssz438	3139 w/ BHT 24 mg/l and MDA 5.8 mg/l	140	Air	1.0	Au
pz089	3145 w/ MDA 5.8 mg/l	140	Air	4.9	Au
ssz439	3139 w/ 8Q406 125 mg/l	140	Air	0.2	Au
pz090	3145 w/ BHT 24 mg/l	140	Air	3.1	Au
ssz440	3139 w/ 8Q406 125 mg/l and MDA 5.8 mg/l	140	Air	0.2	Au
pz091	3145 w/ BHT 24 mg/l and MDA 5.8 mg/l	140	Air	4.9	Au
ssz441	3139	140	Air	7.1	Au
pz092	3145 w/ 8Q406 125 mg/l and MDA 5.8 mg/l	140	Air	0.9	Au
ssz442	3119 w/ triphenyl phosphine 0.075%	140	Air	21	Au
pz093	3145 w/ MDA 12 mg/l	140	Air	3.9	Au
ssz443	3139	140	Air	0.6	Au
pz094	3145 w/ MDA 3 mg/l	140	Air	1.0	Au
ssz444	3119 w/ BHT 24 mg/l	140	Air	18.9	Au
pz095	3145 w/ MDA 3 mg/l	140	Air	4.3	Au
ssz445	2747 (glass liner)	140	Air	0.5	Au
ssz446	3119 (glass liner)	140	Air	23.8	Au
pz096	2827 (glass liner)	140	Air	2.7	Au
ssz447	3119 w/ MDA 5.8 mg/l (glass liner)	140	Air	0.5	Au
pz097	3145 (glass liner)	140	Air	7.6	Au
ssz448	3084 (glass liner)	140	Air	14.6	Au
pz098	3145 w/ MDA 5.8 mg/l (glass liner)	140	Air	12.3	Au
ssz449	3084 w/ MDA 5.8 mg/l (glass liner)	140	Air	1.3	Au
pz099	2827 w/ 3154 190 mg/l (glass liner)	140	Air	2.0	Au
ssz450	2926 w/ 3024 160 mg/l	140	Air	1.3	Au
pz100	3084 w/ 3124 160 mg/l	140	Air	2.0	Au
ssz452	2747 w/ 8Q406 65 mg/l and MCP-1750 220 mg/l	140	Air	0.6	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
pz102	2827 w/ 3155 190 mg/l	140	Air	1.1	Au
pz103	2827 w/ MCP-1750 438 mg/l	140	Air	0.5	Au
ssz453	3119 w/ MCP-1750 438 mg/l	140	Air	7.5	Au
pz104	2827 w/ 3156 190 mg/l	140	Air	1.0	Au
ssz454	2747 w/ MCP-1750 438 mg/l	140	Air	0.5	Au
pz105	2827 w/ 3157 190 mg/l	140	Air	0.5	Au
ssz455	3119 w/ MCP-1750 220 mg/l and 8Q406 65 mg/l	140	Air	5.0	Au
pz106	2827 w/ MCP-1750 220 mg/l and 8Q406 65 mg/l	140	Air	1.2	Au
ssz456	2747 w/ MCP-1750 220 mg/l and 8Q406 65 mg/l (1 week)	140	Air	0.5	Au
pz107	3119 w/ JP-8 additives	140	Air	6.8	Au
ssz457	2963 SPE w/ methanol extract	140	Air	1.9	Au
pz108	2827 w/ 8Q406 125 mg/l	140	Air	2.1	Au
ssz459	2963	140	Air	6.1	Au
pz110	2922 w/ 3150 25 mg/l	140	Air	1.5	Au
pz111	2922 w/ 3151 25 mg/l	140	Air	3.3	Au
pz112	2922 w/ 3152 25 mg/l	140	Air	2.9	Au
pz113	2922 w/ 3153 25 mg/l	140	Air	1.4	Au
pz114	2827 w/ SPE	140	Air	4.4	Au
ssz461	3139 w/ BHT 25 mg/l	140	Air	0.3	Au
pz115	2922 w/ 3163 25 mg/l	140	Air	2.3	Au
pz116	2922 w/ BHT 25 mg/l	140	Air	5.6	Au
ssz462	2827 w/ 8Q460 127 mg/l	140	Air	1.1	Au
pz117	2922 w/ 3164 25 mg/l	140	Air	5.7	Au
ssz463	3119 w/ 8Q460 127 mg/l	140	Air	3.6	Au
pz118	2922 w/ 3165 25 mg/l	140	Air	3.9	Au
ssz464	2747 w/ MCP-1750 220 mg/l and 8Q406 65 mg/l (1 month)	140	Air	0.7	Au
pz119	2827 w/ 3171 125 mg/l	140	Air	0.6	Au
ssz465	3084 w/ tetralin 500 ppm	140	Air	10.2	Au
pz120	2827 w/ 3172 125 mg/l	140	Air	12.3	Au
ssz466	3084	140	Air	11.4	Au
pz121	2827	140	Air	4.2	Au
ssz467	n-dodecane	140	Air (10 psi)	0.2	Au
ssz468	n-dodecane	140	Air (33 psi)	0.4	Au
pz122	2827 w/ 3177 100 mg/l	140	Air	4.1	Au
ssz469	n-dodecane	140	Air (23 psi)	0.3	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
pz123	2922 w/ 3178 25 mg/l	140	Air	4.1	Au
pz124	3119 w/ BHT 25 mg/l and MDA 5.8 mg/l (30 hrs.)	140	Air	4.5	Au
pz125	3119 w/ 8Q406 125 mg/l and MDA 5.8 mg/l (46 hrs)	140	Air	0.5	Au
ssz470	3084 w/ 8Q406 125 mg/l and MDA 5.8 mg/l (46.7 hrs)	140	Air	0.6	Au
pz126	3084 w/ BHT 25 mg/l and MDA 5.8 mg/l (27 hrs)	140	Air	7.3	Au
ssz471	3084 w/ BHT 25 mg/l and MDA 5.8 mg/l	140	Air	1.8	Au
ssz472	3084 w/ BHT 25 mg/l and MDA 5.8 mg/l (57 hrs)	140	Air	0.9	Au
pz127	2827 (20 hrs)	140	Air	4.1	Au
pz128	2827	140	Air	5.2	Au
ssz473	3119	140	Air	21.9	Au
pz130	3119	140	Air	4.7	Au
ssz474	3119	140	Air	21.9	Au
pz131	3119	140	Air	12.9	Au
ssz475	3119	140	Air	15.7	Au
pz132	3119	140	Air	7.1	Au
pz126	3084 w/ BHT 25 mg/l and MDA 5.8 mg/l (27 hrs)	140	Air	7.3	Au
ssz471	3084 w/ BHT 25 mg/l and MDA 5.8 mg/l	140	Air	1.8	Au
ssz472	3084 w/ BHT 25 mg/l and MDA 5.8 mg/l (57 hrs)	140	Air	0.9	Au
pz127	2827 (20 hrs)	140	Air	4.1	Au
pz129	2827 (8 µl 8Q406 added at 3.7 hrs)	140	Air	4.1	Au
ssz473	3119	140	Air	21.9	Au
pz130	3119	140	Air	4.7	Au
ssz474	3119	140	Air	21.9	Au
pz131	3119	140	Air	12.9	Au
ssz475	3119	140	Air	15.7	Au
pz132	3119	140	Air	7.1	Au
ssz476	3119	140	Air	17.5	Au
pz133	3119	140	Air	7.3	Au
ssz477	3119	140	Air	11.4	Au
pz134	3119	140	Air	12.9	Au
ssz478	3119	140	Air	9.2	Au
pz135	3119	140	Air	20.6	Au
pz136	3119	140	Air	18.9	Au
ssz479	3119	140	Air	7.0	Au
pz137	3119	140	Air	12.9	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
ssz480	3119	140	Air	9.6	Au
pz138	3119	140	Air	17.9	Au
ssz481	3145 w/ MDA 5.8 mg/l	140	Air	5.1	Au
pz139	3119 w/ BHT 24 mg/l	140	Air	11.7	Au
pz140	3119 w/ triphenyl phosphine 209 mg/l	140	Air	11.2	Au
pz141	3119	140	Air	22.3	Au
ssz483	3119 w/ triphenyl phosphine 209 mg/l	140	Air	8.4	Au
pz142	3119 w/ BH T 24 mg/l	140	Air	17.6	Au
pz143	3119 w/ MDA 5.8 mg/l	140	Air	4.5	Au
ssz485	2827	140	Air	6.4	Au
pz145	3119 w/ 8Q406 125 mg/l	140	Air	0.3	Au
pz146	3119 w/ 8Q406 125 mg/l and MDA 5.8 mg/l	140	Air	0.2	Au
ssz486	2827 w/ 3180 120 mg/l	140	Air	6.3	Au
pz144	3119 w/ BHT 24 mg/l and MDA 5.8 mg/l	140	Air	1.4	Au
ssz484	2926 w/ 3129 160 mg/l	140	Air	1.4	Au
ssz487	2827 w/ 3181 120 mg/l	140	Air	0.8	Au
ssz488	3204	140	Air	1.0	Au
pz147	3119 w/ 8Q406 125 mg/l and MDA 5.8 mg/l (27.5 hrs)	140	Air	0.2	Au
ssz489	3205	140	Air	0.4	Au
ssz490	2827 w/ 3182 150 mg/l	140	Air	0.7	Au
pz148	3119 w/ BHT 24 mg/l and MDA 5.8 mg/l (88 hrs)	140	Air	0.5	Au
pz149	2827 w/ 3183 120 mg/l	140	Air	1.5	Au
ssz491	3204 w/ BHT 25 mg/l	140	Air	0.5	Au
ssz492	3204 w/ AO-31 25 mg/l	140	Air	0.4	Au
pz150	2827 w/ 3184 120 mg/l	140	Air	3.2	Au
ssz493	3204 w/ AO-24 50 mg/l	140	Air	1.0	Au
pz151	2827 w/ 3185 120 mg/l	140	Air	4.0	Au
ssz494	3204 w/ AO-36 25 mg/l	140	Air	0.2	Au
pz152	2827 w/ 3186 100 mg/l	140	Air	0.6	Au
ssz495	3204 w/ AO-37 25 mg/l	140	Air	1.1	Au
pz153	2827 w/ 3187 100 mg/l	140	Air	2.7	Au
ssz496	3204 w/ Hitec 4702 25 mg/l	140	Air	0.4	Au
ssz497	3204 w/ Hitec 4703 25 mg/l	140	Air	No mass	Au
pz155	2827 w/ 3189 120 mg/l	140	Air	4.4	Au
ssz498	2922 w/ I232 25 mg/l	140	Air	2.2	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
pz156	3119 w/ 8Q406 125 mg/l and MDA 5.8 mg/l (83 hrs)	140	Air	0.2	Au
ssz499	3204 w/ Hitec 4703 25 mg/l	140	Air	No mass	Au
ssz500	3204 w/ Hitec 4763 25 mg/l	140	Air	0.3	Au
pz157	2827 w/ 3190 150 mg/l	140	Air	0.6	Au
ssz501	3204 w/ MDA 5.8 mg/l	140	Air	0.8	Au
pz158	2827 w/ 3191 150 mg/l	140	Air	0.3	Au
pz159	2827 w/ 3192 100 mg/l	140	Air	0.6	Au
ssz502	2922 w/ 3214 25 mg/l	140	Air	3.4	Au
pz160	2827 w/ 3193 100 mg/l	140	Air	0.6	Au
ssz503	2922 w/ 3213 25 mg/l	140	Air	4.0	Au
pz161	2827 w/ 3179 10 g/l	140	Air	1.4	Au
ssz504	2827 w/ 8Q405 100 mg/l, AO-31 25 mg/l, and MDA 2 mg/l	140	Air	1.8	Au
pz162	2827 w/ triphenylphosphine 260 mg/l	140	Helium	1.0	Ag
ssz505	2827 w/ 3202 150 mg/l	140	Air	0.7	Au
ssz506	2827 w/ 3203 125 mg/l	140	Air	0.6	Au
pz163	2827 w/ 3195 100 mg/l	140	Air	0.5	Au
ssz507	2827 w/ 3088 125 mg/l	140	Air	1.1	Au
pz164	2827 w/ 3196 100 mg/l	140	Air	0.7	Au
ssz508	2827	140	Air	4.9	Au
pz165	2827 w/ 3197 100 mg/l	140	Air	0.5	Au
pz166	2827 w/ 3199 100 mg/l	140	Air	0.4	Au
pz154	2827 w/ 3188 100 mg/l	140	Air	1.4	Au
ssz510	2827 w/ 3201 100 mg/l	140	Air	0.9	Au
pz167	2827 w/ 3200 100 mg/l	140	Air	0.4	Au
ssz509	2827 w/ 3198 100 mg/l	140	Air	0.2	Au
pz168	2827 w/ 3194 100 mg/l	140	Air	0.2	Au
ssz511	3119 w/ 3111 144 mg/l, BHT 25 mg/l, and MDA 2mg/l	140	Air	2.0	Au
pz169	2827 w/ 3111 144 mg/l, BHT 25 mg/l, and MDA 2 mg/l (bad run)	140	Air	0.4	Au
pz170	2827 w/ 3114 160 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.8	Au
ssz512	3119 w/ 3114 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	5.0	Au
pz171	3215 (JP-8 +100 Springfield ANG)	140	Air	0.6	Au
ssz513	3119 w/ 3111 144 mg/l and BHT 25 mg/l	140	Air	0.9	Au
pz172	2926 w/ 3111 144 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.3	Au
ssz514	3119 w/ 3114 160 mg/l and BHT 25 mg/l	140	Air	0.4	Au
pz173	2926 w/ 3114 160 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.7	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours (μg/cm²)	Electrode Material
ssz515	2827 w/ 3111 144 mg/l and BHT 25 mg/l	140	Air	0.3	Au
pz174	dodecane w/ elemental S 0.1 mg/l	140	Helium	0.25	Ag
ssz516	2827 w/ 3114 160 mg/l and BHT 25 mg/l	140	Air	0.6	Au
pz175	dodecane w/ elemental S 1.05 mg/l	140	Air	0.4	Ag
ssz517	2926 w/ 3111 144 mg/l and BHT 25 mg/l	140	Air	1.4	Au
pz176	dodecane w/ elemental S 10.5 mg/l	140	Helium	5.8	Ag
ssz518	2926 w/ 3114 160 mg/l and BHT 25 mg/l	140	Air	0.4	Au
pz177	2827 w/ 3111 144 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.5	Au
ssz519	3119 w/ SDA, BHT, and MDA 627 mg/l	140	Air	0.4	Au
pz178	2827 w/ SDA, BHT, and MDA 627 mg/l	140	Air	4.3	Au
ssz520	2926 w/ SDA, BHT, and MDA 627 mg/l	140	Air	1.2	Au
pz179	2827 w/ SDA, BHT, and MDA 627 mg/l	140	Air	3.0	Au
pz180	dodecane w/ elemental S 11 mg/l	140	Helium	16.1	Ag
pz181	2827 w/ SDA 600 mg/l	140	Air	1.6	Au
ssz521	3119 w/ SDA 600 mg/l	140	Air	6.3	Au
pz182	dodecane w/ elemental S 1.1 mg/l	140	Helium	15.2	Ag
ssz522	2926 w/ SDA 600 mg/l	140	Air	2.0	Au
pz183	dodecane w/ elemental sulfur 0.11 mg/l	140	Helium	1.1	Au
ssz523	3066	140	Air	10.7	Au
pz184	2827 w/ SDA 10 ml/l	140	Air	1.0	Au
ssz524	3205 w/ AO-24 50 mg/l	140	Air	1.3	Au
pz185	2827 after SPE	140	Air	1.0	Au
ssz525	3205 w/ BHT 25 mg/l	140	Air	0.2	Au
pz186	3166 w/ BHT 25 mg/l	140	Air	7.5	Au
ssz526	3119 w/ 3171 125 mg/l	140	Air	2.5	Au
pz187	2922 w/ AO-24 50 mg/l	140	Air	3.9	Au
ssz527	2926 w/ 3171 125 mg/l	140	Air	1.0	Au
pz188	3166 w/ 8Q406 125 mg/l	140	Air	1.2	Au
pz189	3166 w/ MDA 5.8 mg/l	140	Air	0.75	Au
pz190	3166 w/ 8Q406 125 mg/l and MDA 2 mg/l (22 hrs)	140	Air	0.2	Au
ssz528	3119 w/ 3198 100 mg/l	140	Air	4.3	Au
pz191	3216 (JP-8 from Staniford Field, KY)	140	Air	1.8	Au
pz192	3217 (JP-8+100 from Staniford Field, KY)	140	Air	0.1	Au
pz193	BP Bender treated outlet	140	Air	2.6	Au
pz194	3119 after I.C. chelate	140	Air	7.4	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
ssz529	3119	140	Air	15.3	Au
pz195	3119	140	Air	7.4	Au
ssz530	1-K kerosine from BP	140	Air	0.4	Au
pz196	3119 after I.C. chelate w/ MDA 2 mg/l	140	Air	6.7	Au
pz197	3119 w/ 3200 100 mg/l	140	Air	3.1	Au
ssz531	2827 w/ GTA additve 10 ppm	140	Air	2.2	Au
pz198	3145 after I.C. chelate	140	Air	5.5	Au
pz199	3119 w/ MDA 2 mg/l	140	Air	10.8	Au
ssz532	3084	160	Air	1.1	Au
pz200	3145 w/ MDA 2 mg/l	140	Air	6.4	Au
ssz533	3084	140	Oxygen 4 psi (Heat up with Nitrogen)	7.7	Au
pz201	3145 after I.C. chelate w/ MDA 2 mg/l	140	Air	5.8	Au
ssz534	3084	160	Oxygen 4.8 psi (Heat up with Nitrogen)	7.6	Au
ssz535	3084	170	Oxygen 4.8 psi (Heat up with Nitrogen)	6.5	Au
ssz536	3084	180	Oxygen 4.8 psi (Heat up with Nitrogen)	5.2	Au
ssz537	3119	140	Oxygen 4.2 psi (Heat up with Nitrogen)	7.7	Au
ssz538	3119	160	Oxygen 4.3 psi (Heat up with Nitrogen)	6.5	Au
pz202	3166	140	Air	9.6	Au
ssz539	3119	170	Oxygen 4.5 psi (Heat up with Nitrogen)	6.0	Au
pz203	3166 (w/ dirty crystal)	140	Air	5.4	Au
ssz540	3119	180	Oxygen 4.8 psi (Heat up with Nitrogen)	3.0	Au
pz204	3166	140	Air	6.5	Au
ssz541	3119	170	Oxygen 4.5 psi (Heat up with Nitrogen)	4.1	Au
pz205	3166 (w/ dirty system)	140	Air	9.1	Au
ssz542	3119	150	Oxygen 4.3 psi (Heat up with Nitrogen)	9.6	Au
ssz543	3084	150	Oxygen 4.4 psi (Heat up with Nitrogen)	9.8	Au
ssz544	3119 w/ 8Q406 125 mg/l	140	Oxygen 4.1 psi (Heat up with Nitrogen)	9.3	Au
ssz545	3119 w/ 8Q406 125 mg/l	150	Oxygen 4.2 psi (Heat up with Nitrogen)	5.8	Au
pz206	2827 w/ SDA, BHT, and MDA	140	Air	0.7	Au
ssz546	3119 w/ 8Q406 125 mg/l	160	Oxygen 4.6 psi (Heat up with Nitrogen)	4.8	Au
ssz547	3119 w/ 8Q406 125 mg/l	170	Oxygen 4.4 psi (Heat up with Nitrogen)	3.8	Au
pz207	2926	140	Air	2.9	Au
ssz548	3119 w/ 8Q406 125 mg/l	180	Oxygen 4.7 psi (Heat up with Nitrogen)	2.5	Au
pz208	2747	100	Oxygen 4.0 psi (Heat up with Nitrogen)	0.4	Au
pz209	2747 w/ Co catalyst (22 hrs)	100	Oxygen 4.0 psi (Heat up with Nitrogen)	6.1	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
pz211	2747	140	Oxygen 4.1 psi (Heat up with Nitrogen)	1.2	Au
pz212	2747 w/ Co catalyst	140	Oxygen 4.1 psi (Heat up with Nitrogen)	4.2	Au
pz213	2747 w/ Co catalyst and aldehyde	140	Oxygen 4.1 psi (Heat up with Nitrogen)	3.0	Au
ssz549	2827	140	Air	3.4	Au
pz210	2747 w/ Co catalyst and aldehyde	100	Oxygen 4.0 psi (Heat up with Nitrogen)	1.4	Au
pz214	2747 w/ Co catalyst and aldehyde(2x)	140	Oxygen 4.1 psi (Heat up with Nitrogen)	4.6	Au
ssz550	3119	140	Air	9.6	Au
pz215	2747 w/ Co catalyst and aldehyde(0.5x)	140	Oxygen 4.1 psi (Heat up with Nitrogen)	3.5	Au
ssz551	3229 (JP-8+100 from Burlington, VT)	140	Air	0.4	Au
pz216	2747 w/ Co catalyst and isopropanol	140	Oxygen 4.1 psi (Heat up with Nitrogen)	4.0	Au
ssz552	3230 (JP-8 from Burlington, VT)	140	Air	3.0	Au
pz217	2747 w/ Co catalyst, aldehyde, and isopropanol	140	Oxygen 4.1 psi (Heat up with Nitrogen)	1.2	Au
ssz553	3232 (JP-8 from Otis ANG)	140	Air	2.9	Au
pz218	3234 (JP-8 from Westfield, MA)	140	Air	1.3	Au
ssz554	3233 (JP-8+100 from Otis ANG)	140	Air	0.4	Au
pz219	3235 (JP-8+100 from Westfield, MA)	140	Air	0.3	Au
ssz555	3119 w/ 3199 100 mg/l	140	Air	4.6	Au
pz220	2926 w/ 3199 100 mg/l	140	Air	1.0	Au
ssz556	3119 w/ 3199 100 mg/l and BHT 25 mg/l	140	Air	1.5	Au
pz221	2926 w/ 3199 100 mg/l and BHT 25 mg/l	140	Air	0.3	Au
ssz557	3119 w/ 3199 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.2	Au
pz222	2926 w/ 3199 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.1	Au
pz223	2827 w/ 3199 100 mg/l and BHT 25 mg/l	140	Air	0.4	Au
ssz558	2747 w/ MCP-1750 220 mg/l and 8Q406 65 mg/l (6 months)	140	Air	1.3	Au
pz224	2827 w/ 3199 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.4	Au
ssz559	3119 w/ MCP-1750 220 mg/l and 8Q406 65 mg/l (6 months)	140	Air	5.5	Au
pz225	3242 (JP-8 from Westfield, MA)	140	Air	1.8	Au
ssz560	2827 w/ MCP-1750 220 mg/l and 8Q406 65 mg/l (6 months)	140	Air	0.5	Au
pz226	3243 (JP-8+100 from Westfield, MA)	140	Air	0.2	Au
ssz561	2827 w/ 8Q462 256 mg/l	140	Air	1.2	Au
pz227	2926 w/ 3157 190 mg/l	140	Air	0.7	Au
ssz562	2926 w/ 8Q462 256 mg/l	140	Air	0.4	Au
pz228	3084 w/ 3157 190 mg/l	140	Air	1.0	Au
ssz563	3084 w/ 8Q462 256 mg/l	140	Air	0.7	Au
pz229	3119 w/ 3157 190 mg/l	140	Air	0.5	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
ssz564	3119 w/ 8Q462 256 mg/l	140	Air	0.6	Au
pz230	2827 w/ 3237 165 mg/l	140	Air	0.9	Au
ssz565	3084 w/ 8Q405 100 mg/l	140	Oxygen 4.2 psi (Heat up with Nitrogen)	3.6	Au
pz231	2827 w/ 3238 165 mg/l	140	Air	2.7	Au
ssz566	3084 w/ 8Q405 100 mg/l	150	Oxygen 4.2 psi (Heat up with Nitrogen)	4.7	Au
pz232	2827 w/ 3239 165 mg/l	140	Air	0.6	Au
ssz567	3084 w/ 8Q405 100 mg/l	160	Oxygen 4.5 psi (Heat up with Nitrogen)	3.2	Au
pz233	2827 w/ 3241 165 mg/l	140	Air	0.5	Au
ssz568	3084 w/ 8Q405 100 mg/l	170	Oxygen 5.0 psi (Heat up with Nitrogen)	4.8	Au
pz234	2827 w/ 3240 165 mg/l	140	Air	0.9	Au
ssz569	3084 w/ 8Q405 100 mg/l	180	Oxygen 4.6 psi (Heat up with Nitrogen)	3.0	Au
pz235	3204 w/ AO-24 50 mg/l	140	Air	2.2	Au
ssz570	3084 w/ 8Q405 100 mg/l	170	Oxygen 4.4 psi (Heat up with Nitrogen)	3.8	Au
pz236	2827 w/ 3182 150 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.3	Au
ssz571	2827 w/ 3188 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	1.3	Au
pz237	3204 w/ AO-24 20 mg/l	140	Air	1.8	Au
ssz572	2827 w/ 3190 150 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.7	Au
pz238	3204 w/ AO-24 10 mg/l	140	Air	1.7	Au
ssz573	2827 w/ Wynne's Additive	140	Air	1.3	Au
pz239	3204 w/ BHT 25 mg/l	140	Air	2.6	Au
ssz574	2827 w/ 3129 190 mg/l	140	Air	2.7	Au
pz240	3204	140	Air	1.6	Au
ssz575	2827 w/ 3245 150 mg/l	140	Air	0.7	Au
ssz576	2827 w/ 3246 150 mg/l	140	Air	0.6	Au
ssz577	2827 w/ 3247 150 mg/l	140	Air	0.6	Au
ssz578	2827 w/ 3248 150 mg/l	140	Air	0.8	Au
ssz579	2827 w/ 3249 100 mg/l	140	Air	0.7	Au
ssz580	2926 w/ 3202 150 mg/l	140	Air	0.9	Au
ssz581	3119 w/ 3202 150 mg/l	140	Air	2.9	Au
ssz582	2827 w/ 3171 125 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.5	Au
pz241	3084 w/ 8Q405 100 mg/l, AO-24 10 mg/l, and MDA 2 mg/l	140	Air	0.1	Au
ssz583	2926 w/ 3171 125 mg/l, BHT 25 mg/l and MDA 2 mg/l	140	Air	0.8	Au
pz242	3119 w/ 8Q405 100 mg/l, AO-24 10 mg/l and MDA 2 mg/l	140	Air	0.1	Au
ssz584	3119 w/ 3171 125 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.3	Au
pz243	2827 w/ 8Q405 100 mg/l, AO-24 10 mg/l, and MDA 2 mg/l	140	Air	0.5	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
pz244	3119 w/ 8Q405 100 mg/l, AO-24 10 mg/l, and MDA 2 mg/l (95 hours)	140	Air	7.0	Au
ssz585	2827 w/ PL-1740 100 mg/l and BHT 25 mg/l	140	Air	0.5	Au
pz245	2926 w/ 8Q405 100 mg/l, AO-24 10 mg/l, and MDA 2 mg/l	140	Air	0.1	Au
ssz586	2827 w/ PL-1740 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.3	Au
pz246	2827 w/ MCP-1750B 962 mg/l	140	Air	0.2	Au
ssz587	2926 w/ PL-1740 100 mg/l	140	Air	1.3	Au
pz247	2827 w/ MCP-1750C 505 mg/l	140	Air	0.3	Au
ssz588	2926 w/ PL-1740 100 mg/l and BHT 25 mg/l	140	Air	0.6	Au
pz248	3145	140	Air	5.9	Au
ssz589	2926 w/ PL-1740 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.3	Au
pz249	3145 w/ MDA 5.8 mg/l	140	Air	4.5	Au
ssz590	3259 Jet-A from Staniford Field, KY	140	Air	7.1	Au
ssz591	3260 (JP-8 from Staniford Field, KY)	140	Air	0.7	Au
pz250	3265 (JP-8 from GE)	140	Air	2.0	Au
ssz592	3261 (JP-8+100 from Staniford Field, KY)	140	Air	0.05	Au
pz251	3266 (JP-8+100 from GE)	140	Air	0.4	Au
pz252	3119 w/ MCP-1750B 962 mg/l	140	Air	0.4	Au
ssz593	2827 w/ 3182 150 mg/l, AO-24 10 mg/l, and MDA 2 mg/l	140	Air	0.4	Au
pz253	3119 w/ MCP-1750C 505 mg/l	140	Air	0.4	Au
ssz594	2827 w/ 3188 100 mg/l, AO-24 10 mg/l, and MDA 2 mg/l	140	Air	0.6	Au
pz254	3267 (JP-8 from Kingsley Field)	140	Air	1.5	Au
ssz595	2827 w/ 3190 150 mg/l, AO-24 10 mg/l, and MDA 2 mg/l	140	Air	1.4	Au
ssz596	2827 w/ 3263 160 mg/l	140	Air	0.3	Au
pz256	3204 w/ 3264 5 mg/l	140	Air	1.8	Au
ssz597	2827 w/ 3262 0.6 wt% Wynne's Addtive	140	Air	4.0	Au
pz257	2827 w/ 3244 1.0 wt% Soydiesel	140	Air	3.0	Au
pz258	2926 w/ MCP-1750B 962 mg/l	140	Air	0.3	Au
ssz598	3084 w/ 3245 150 mg/l	140	Air	0.8	Au
pz259	2926 w/ MCP-1750C 505 mg/l	140	Air	0.5	Au
ssz599	3119 w/ 3245 150 mg/l	140	Air	1.0	Au
pz260	3084 w/ MCP-1750B 962 mg/l	140	Air	0.0	Au
ssz600	2926 w/ 3245 150 mg/l	140	Air	1.7	Au
pz261	3084 w/ MCP-1750C 505 mg/l	140	Air	0.2	Au
ssz601	3119 Cu doped/stressed in EDTST preheater	140	Air	4.2	Au
pz262	3272 (JP-8 from Springfield)	140	Air	2.8	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours (μg/cm^2)	Electrode Material
pz263	3273 (JP-8+100 from Springfield)	140	Air	0.2	Au
ssz602	Texaco TXB-54-176	140	Air	4.4	Au
pz264	Hunt 96-178-1, JP-8	140	Air	0.8	Au
ssz603	3279 Hunt 96-178-7, JP-8	140	Air	4.2	Au
pz265	3280 Hunt 96-178-6, JP-8	140	Air	2.3	Au
ssz604	3281 Hunt 96-178-8, JP-8	140	Air	7.4	Au
pz266	2827 w/ 3274 236 mg/l	140	Air	1.7	Au
ssz605	2926 w/ 3182 150 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.3	Au
pz267	2827 w/ 3275 251 mg/l	140	Air	0.6	Au
pz268	2827 w/ 3276 256 mg/l	140	Air	0.4	Au
ssz606	2926 w/ 3188 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.4	Au
pz269	2827 w/ 3177 100 mg/l	140	Air	3.0	Au
pz270	2926 w/ 3190 150 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.3	Au
ssz607	2827 w/ 8Q405 100 mg/l	140	Air	0.6	Au
pz271	3119 w/ 3182 150 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.9	Au
ssz608	3084 w/ 3182 150 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.6	Au
pz272	3119 w/ 3188 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	1.2	Au
ssz609	3084 w/ 3188 100 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.5	Au
pz273	3119 w/ 3190 150 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.3	Au
ssz610	3084 w/ 3190 150 mg/l, BHT 25 mg/l, and MDA 2 mg/l	140	Air	0.1	Au
pz274	2926 w/ 3263 160 mg/l	140	Air	0.4	Au
pz275	3119 w/ 3263 160 mg/l	140	Air	0.5	Au
pz276	3119	140	Air	10.3	Au
pz277	3084 w/ 3263 160 mg/l	140	Air	0.5	Au
pz278	3281 w/ 8Q462 256 mg/l	140	Air	0.1	Au
ssz611	3084 w/ 3239 165 mg/l	140	Air	0.6	Au
pz279	3119 w/ 3239 165 mg/l	140	Air	0.2	Au
ssz612	3084 w/ 3241 165 mg/l	140	Air	0.4	Au
pz280	2926 w/ 3239 165 mg/l	140	Air	1.1	Au
pz281	3119 w/ 3241 165 mg/l	140	Air	0.3	Au
ssz613	2926 w/ 3241 165 mg/l	140	Air	0.2	Au
pz282	2827 w/ PL-1746 293 mg/l	140	Air	0.2	Au
pz255	3268 (JP-8+100 from Kingsley)	140	Air	0.6	Au
ssz614	2926	140	Air	3.4	Au
pz283	2827 w/ PL-1747 458 mg/l	140	Air	0.6	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
ssz615	3084	140	Air	11.8	Au
ssz616	2827 w/ 3291 160 mg/l	140	Air	0.3	Au
pz284	3119 w/ 3291 160 mg/l	140	Air	1.4	Au
ssz617	2827 w/ 3292 160 mg/l	140	Air	0.2	Au
pz285	2827 w/ 3293 180 mg/l	140	Air	0.6	Au
ssz618	2827 w/ 3294 180 mg/l	140	Air	0.4	Au
pz286	3285 (JP-8 from Sheppard)	140	Air	1.2	Au
ssz619	2827	140	Air	2.8	Au
pz287	3286 (JP-8+100 from Sheppard)	140	Air	0.6	Au
pz288	Exxsol D-110	140	Air	0.9	Au
pz289	Exxsol D-110 w/ BHT 50 mg/l	140	Air	0.2	Au
ssz620	3296 (JP-8+100 from Louisville)	140	Air	0.1	Au
pz290	Exxsol D-110 w/ BHT 25 mg/l	140	Air	0.7	Au
pz291	Exxsol D-110 w/ BHT 10.7 mg/l	140	Air	0.9	Au
ssz621	3119 w/ POSF-3263 160 mg/l and POSF-3290 100 mg/l	140	Air	1.0	Au
pz292	Exxsol D-110 w/ BHT 4.2 mg/l	140	Air	1.3	Au
ssz622	2827 w/ 3295 327 mg/l	140	Air	1.0	Au
pz293	Exxsol D-110 w/ BHT 38.3 mg/l	140	Air	0.3	Au
pz294	Exxsol D-110 w/ BHT 50 mg/l	140	Air	-0.4	Au
ssz623	2827 w/ modified SDA	140	Air	3.6	Au
ssz624	2827	140	Air	3.9	Au
pz295	Exxsol D-110 w/ BHT 55.6 mg/l	140	Air	0.8	Au
pz296	2827	140	Air	1.7	Au
pz297	2827	140	Air	1.3	Au
ssz625	2827	140	Air	2.1	Au
ssz626	2827	140	Air	3.4	Au
pz298	2827	140	Air	1.4	Au
ssz627	2827	140	Air	1.1	Au
pz299	3084	140	Air	8.3	Au
ssz628	3084	140	Air	7.8	Au
pz300	3119	140	Air	11.6	Au
ssz629	3119	140	Air	9.8	Au
pz301	2747	140	Air	0.8	Au
ssz630	2747	140	Air	0.9	Au
pz302	3119	140	Air		Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
ssz631	3119	140	Air		Au
ssz632	SPE 3119	140	Air	3.9	Au
ssz633	SPE of 2827	140	Air	0.8	Au
ssz634	SPE 3084	140	Air	2.8	Au
ssz635	3166	140	Air	10.1	Au
ssz636	SPE 3166	140	Air	2.1	Au
pz303	3119	140	Air	17.3	Au
pz304	3119	140	Air	12.6	Au
pz305	3119 - Switched clamps w/ QCM #1	140	Air	10	Au
pz306	3119 - Switched clamps w/ QCM #1	140	Air	14.0	Au
ssz637	3119 with original clamps	140	Air	18.6	Au
ssz638	3084 - w/ 3rd clamp	140	Air	13.6	Au
pz307	3084	140	Air	5.6	Au
ssz639	3084	140	Air	13.6	Au
pz308	3084 w/ original clamp	140	Air	10.0	Au
ssz640	3084 w/ original clamp	140	Air	12.5	Au
ssz641	3119 - Filtered 1μm	140	Air	19.5	Au
pz309	3084 - Filtered 1μm	140	Air	7.5	Au
pz310	3084 - Filtered 0.1μm	140	Air	12.6	Au
pz311	3084 - Filtered 0.1 μm	140	Air	9.5	Au
ssz642	3119 - Filtered 0.1 μm	140	Air	22.3	Au
pz312	3084 - Filtered 0.7 μm	140	Air	9.8	Au
pz313	SPE 2976	140	Air	0.3	Au
ssz643	2976	140	Air	0.5	Au
pz314	2827 w/ 3304 100 mg/L	140	Air	3.1	Au
ssz644	2827 w/ .6 wt% 3262 & 256 mg/L 8Q462	140	Air	7.3	Au
pz315	2827 w/ 3300 160 mg/L	140	Air	0.8	Au
ssz645	2926 w/ 3300 160 mg/L	140	Air	1.1	Au
pz316	2827 w/ 3303 200 mg/L	140	Air	0.8	Au
ssz646	3084 w/ 3300 160 mg/L	140	Air	0.9	Au
ssz647	2926 w/ 3303 200 mg/L	140	Air	3.6	Au
pz317	3084 w/ 3303 200 mg/L	140	Air	3.1	Au
pz318	2827 w/ 3301 160 mg/L	140	Air	1.1	Au
ssz648	2926 w/ 3301 160 mg/L	140	Air	1.0	Au
pz319	3084 w/ 3301 160 mg/L	140	Air	0.9	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
ssz649	3119 w/ 3295 327 mg/L	140	Air	0.4	Au
pz320	2827 w/ 3306 26 mL/L	140	Air	0.2	Au
ssz650	2827 w/ 3307 26 mL/L	140	Air	1.1	Au
pz321	2827 w/ Nalco 3203/BHT/MDA	140	Air	1.7	Au
pz322	3119 w/ PL-1747 458 mg/L	140	Air	2.0	Au
ssz651	2926 w/ PL-1747 458 mg/L	140	Air	1.2	Au
pz323	3119 w/ 3303 200 mg/L	140	Ait	0.5	Au
ssz652	3119 w/ 3302 200 mg/L	140	Air	3.0	Au
ssz653	3119 w/ 3300 160 mg/L	140	Air	0.5	Au
pz324	3119 w/ 3301 160 mg/L	140	Air	0.6	Au
pz326	Exxsol D-110 w/ 46.7 mg/L Butyl Sulfide	140	Air	2.2	Au
pz327	Exxsol D-110 w/ 25.15 mg/L Butyl Sulfide	140	Air	0.5	Au
ssz654	POSF-3323 - JP8+100 (8Q462)	140	Air	0.8	Au
ssz655	POSF-3322 - JP8	140	Air	2.5	Au
pz328	Exxsol D-110 w/ 100 mg/L Butyl Sulfide	140	Air	0.6	Au
pz329	Exxsol D-110 w/ 25 mg/L Butyl Sulfide	140	Air	0.5	Au
ssz656	2827 w/ 3312 26 mL/L	140	Air	10.2	Au
pz330	Exxsol D-110 w/ 50 mg/L Butyl Sulfide	140	Air	0.6	Au
ssz657	2827 w/ 3310 26 mL/L	140	Air	2.0	Au
pz331	Exxsol D-110 w/ 300 mg/L ButylSulfide	140	Air	0.6	Au
ssz658	2827 w/ 3311 26 mL/L	140	Air	12.0	Au
pz332	Exxsol D-110	160	Air 15 psi (Heat-up with Nitrogen)	0.4	Au
ssz659	POSF-2827	140	Air	1.7	Au
ssz660	2827 w/ 3313 26 mL/L	140	Air	9.5	Au
ssz661	2827 w/ 3314 26 mL/L	140	Air	3.4	Au
pz333	Exxsol D-110 w/ 300 mg/L Butyl Sulfide	160	Air 15 psi (heat up with Nitrogen)	1.0	Au
ssz662	2827 w/ 3315 26 mL/L	140	Air	0.3	Au
ssz663	2827 w/ 3316 26 mL/L	140	Air	4.7	Au
pz334	Exxsol D-110 w/ 300 mg/L Butyl Sulfide	160	Air	1.0	Au
ssz664	2827 w/ 3317 26 mL/L	140	Air	2.0	Au
pz335	2827 w/ 3318 26 mL/L	140	Air	0.2	Au
ssz665	2827 w/ 3319 26 mL/L	140	Air	2.8	Au
pz336	2827 w/ 3320 26 mL/L	140	Air	9.3	Au
pz337	2827 w/ 3321 26 mL/L	140	Air	2.6	Au
ssz666	2827 w/ 3309 100 mg/L	140	Air	0.9	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
ssz667	2827 w/ 3308 100 mg/L	140	Air	1.2	Au
ssz668	3272 (JP8)	140	Air	3.0	Au
pz338	3273 (JP8+100)	140	Air	0.5	Au
pz339	3289 (JP8+100)	140	Air	0.4	Au
ssz669	3288 (JP8)	140	Air	3.5	Au
pz341	Exxsol D-110 w/ Hexyl Sulfide 3230 mg/L	140	Air	0.2	Au
pz342	Exxsol D-110 w/ Hexyl Sulfide 1662 mg/L	140	Air	0.6	Au
pz343	Exxsol D-110 w/ Hexyl Sulfide 2384 mg/L	140	Air	1.1	Au
ssz670	3305A w/ BHT+MDA+Cu - Stored @ 140 C for 30 days	140	Air	3.6	Au
pz344	Exxsol D-110 w/ Hexyl Sulfide 3338 mg/L	140	Air	0.2	Au
pz345	Exxsol D-110 w/ BHT 50 mg/L	140	Air	0.5	Au
pz346	Exxsol D-110 w/ BHT 50 mg/L & Hexyl Sulfide 3017 mg/L	140	Air	0.2	Au
pz347	Exxsol D-110 w/ BHT 23.9 mg/L & Hexyl Sulfide 3082 mg/L	140	Air	0.5	Au
pz348	Exxsol D-110 w/ BHT 23.9 mg/L	140	Air	0.0	Au
ssz671	2827 w/ MDA 2.8 mg/L & 8Q406 125 mg/L	140	Air	1.6	Au
pz350	2985 w/ 8Q462 256 mg/L	140	Air	6.4	Au
pz351	2985 w/ 8Q462 256 mg/L (Heated for 4 hrs.)	140	Air	-	Au
ssz672	3084 - SPE	140	Air	2.3	Au
pz352	3145 w/ BHT 24 mg/L	140	Air	7.9	Au
ssz673	2827	140	Air	2.8	Au
pz353	SPE 3145 w/ BHT 24 mg/L	140	Air	1.9	Au
pz354	SPE 3084 (prep. w/ heptane)	140	Air	2.2	Au
ssz674	3084 - Added Extract Back to Fuel	140	Air	2.7	Au
ssz675	2747 w/ 2827 Extract (SPE)	140	Air	5.9	Au
pz355	SPE 3145 w/ BHT 24 mg/L (10g. silica)	140	Air	3.9	Au
pz356	SPE 3166 (heptane wash)	140	Air	2.8	Au
ssz676	2926 w/ 3271 458 mg/L	140	Air	0.5	Au
ssz677	3119 w/ 3271 458 mg/L	140	Air	1.7	Au
pz357	2827 w/ 3346 160 mg/L	140	Air	1.1	Au
ssz678	2827 w/ 3345 160 mg/L	140	Air	0.5	Au
pz358	2827 w/ 3348 45 mg/L	140	Air	2.8	Au
pz359	2827 w/ 3309 100 mg/L & BHT 25 mg/L & MDA 2 mg/L	140	Air	0.5	Au
ssz679	2827 w/ 3308 100 mg/L & BHT 25 mg/L & MDA 2 mg/L	140	Air	0.7	Au
ssz680	3119 w/ 3307 26 mL/L	140	Air	0.5	Au
pz360	3351 (JP-8 - Edwards AFB)	140	Air	7.0	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
pz361	3326 (JP-8+100 - Kirtland AFB)	140	Air	0.8	Au
ssz681	3325 (JP-8 - Kirtland AFB)	140	Air	1.7	Au
pz362	3119 w/ 3309 100 mg/L & BHT 25 mg/L & MDA 2 mg/L	140	Air	0.3	Au
ssz682	3119 w/ 3308 100 mg/L & BHT 25 mg/L & MDA 2 mg/L	140	Air	0.5	Au
pz363	2926 w/ 3309 100 mg/L & BHT 25 mg/L & MDA 2 mg/L	140	Air	0.3	Au
ssz683	2926 w/ 3308 100 mg/L & BHT 25 mg/L & MDA 2 mg/L	140	Air	0.6	Au
ssz684	2963 SPE Fuel (1 g./no C7 wash)	140	Air	0.6	Au
pz364	2963	140	Air	5.9	Au
pz365	2963 SPE Fuel (10 g./no C7 wash)	140	Air	0.5	Au
ssz685	3329 (JP8+100 - Otis ANG)	140	Air	0.1	Au
pz367	3334 (JP8 - Otis ANG)	140	Air	1.5	Au
pz368	2980 w/ 500 ppb Cu	140	Air	5.2	Au
ssz686	3353 (JP8 - Kirtland AFB)	140	Air	2.0	Au
pz370	2980 w/ 1 ppm Cu	140	Air	4.9	Au
pz369	2980	140	Air	1.2	Au
pz366	2963 SPE Fuel (10 g. bed; C7 Wash)	140	Air	0.8	Au
pz371	2980 SPE Fuel (10g;C7)	140	Air	3.3	Au
ssz687	3350 (JP8+100 - Sheppard AFB)	140	Air	0.5	Au
pz373	2827 w/ 3363 200 mg/L	140	Air	0.7	Au
ssz689	2827 w/ 3362 200 mg/L	140	Air	0.6	Au
pz374	2827 w/ 3365 220 mg/L	140	Air	0.6	Au
ssz690	2827 w/ 3361 200 mg/L	140	Air	0.9	Au
pz375	2827 w/ 3358 200 mg/L	140	Air	0.6	Au
ssz691	2827 w/ 3357 200 mg/L	140	Air	0.7	Au
pz376	2827 w/ 3366 200 mg/L	140	Air	0.6	Au
pz378	2827 w/ PL-1763 229 mg/L	140	Air	2.9	Au
pz377	2980 w/ 50 ppb Cu	140	Air	1.0	Au
ssz692	2827 w/ PL-1762 229 mg/L	140	Air	1.5	Au
pz379	2827 w/ PL-1764 229 mg/L	140	Air	1.7	Au
ssz693	2827 w/ PL-1755 458 mg/L	140	Air	0.5	Au
pz380	2827 w/ PL-1756 229 mg/L	140	Air	0.5	Au
ssz694	2827 w/ PL-1757 229 mg/L	140	Air	0.6	Au
pz382	2827 w/ PL-1758 229 mg/L	140	Air	0.8	Au
pz383	2827 w/ PL-1759 229 mg/L	140	Air	0.5	Au
ssz695	3352 (JP8+100 - Kirtland AFB)	140	Air	0.7	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
ssz696	2827 w/ PL-1760 305 mg/L	140	Air	0.6	Au
pz384	2980 w/ 1 mL HMDS	140	Air	0.4	Au
pz385	100 mL 2747 w/ 1 mL Co Acetylacetonate & w/ 1 mL Benzaldehyde	140	Air	1.9	Au
ssz697	2827 w/ PL-1761 305 mg/L	140	Air	4.1	Au
pz386	3119 w/ 1 mL HMDS (60:1)	140	Air	0.7	Au
ssz698	2827 w/ PL-1765 305 mg/L	140	Air	1.3	Au
pz387	2980 w/ 0.5 mL HMDS (60:0.5)	140	Air	0.7	Au
pz388	2980 w/ 0.1 ml HMDS	140	Air	10.7	Au
ssz699	2827 w/ PL-1766 229 mg/L	140	Air	0.3	Au
ssz700	3322 - JP8 - Kirtland AFB	140	Air	1.5	Au
pz389	2980 w/ 0.1 mL HMDS	140	Air	9.5	Au
pz390	3119 w/ 0.1 mL HMDS	140	Air	1.3 (?)	Au
pz391	100 mL 2747 w/ 1 mL Co Acetylacetonate (OLD) & w/ 1 mL	140	Air	0.9	Au
ssz701	3323 - JP8+100 - Kirtland AFB	140	Air	0.5	Au
ssz702	3349 - JP8 - Sheppard AFB	140	Air	1.5	Au
pz392	100 mL 2747 w/ 1 mL Co Benzylacetonate w/ 1 mL Benzaldehyde	140	Air	0.8	Au
pz393	100 mL 2747 w/ Co Benzylacetonate (OLD) & w/ 1 mL Benzaldehyde	140	Air	0.9	Au
ssz703	3342 - JP8+100 - Nashville	140	Air	0.7	Au
ssz704	3343 - JP8 - Nashville	140	Air	1.0	Au
pz394	3305	140	Air	3.5	Au
pz395	3219	140	Air	3.1	Au
pz396	3119 w/ 0.1 mL HMDS	140	Air	5.5	Au
pz397	3119 w/ HMDS 50 μL	140	Air	9.5	Au
ssz706	3324	140	Air	0.3	Au
pz398	2980 w/ 0.2 mL HMDS	140	Air	6.3	Au
ssz705	3379 - JP8+100	140	Air	0.8	Au
pz399	2980 w/ 0.3 mL HMDS	140	Air	2.7	Au
ssz707	3393 - JP8+100	140	Air	1.3	Au
pz400	2980 w/ 0.4 mL HMDS	140	Air	1.4	Au
ssz708	2926 w/ 3357 200 mg/L	140	Air	0.1	Au
pz401	3084 w/ 0.5 mL HMDS	140	Air	0.7	Au
pz402	3084 w/ 0.1 mL HMDS	140	Air	7.9	Au
ssz709	2926 w/ 3358 200 mg/L	140	Air	0.7	Au
pz403	2980 (neat - 80 hours)	140	Air	1.0	Au
ssz710	2926 w/ 3359 200 mg/L	140	Air	2.0	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
pz404	2926 w/ 3360 200 mg/L	140	Air	0.7	Au
pz406	2926 w/ 3363 200 mg/L	140	Air	1.1	Au
ssz712	2926 w/ 3362 200 mg/L	140	Air	0.9	Au
ssz711	2926 w/ 3361 200 mg/L	140	Air	0.8	Au
pz407	2926 w/ 3366 200 mg/L	140	Air	0.8	Au
ssz713	2926 w/ 3365 200 mg/L	140	Air	1.3	Au
pz408	2980 w/ 100 µL TMSI (Filtered)	140	Air	1.2	Au
pz409	3119 w/ 3359 200 mg/L	140	Air	0.4	Au
ssz714	3119 w/ 3358 200 mg/L	140	Air	1.8	Au
ssz715	3119 w/ 3360 200 mg/L	140	Air	0.2	Au
pz410	3119 w/ 3361 200 mg/L	140	Air	0.5	Au
pz405	2980 w/ 5 uL TMSI	140	Air	0.9	Au
pz411	3119 w/ 3363 200 mg/L	140	Air	0.3	Au
pz412	2980 w/ 0.4 mL HMDS	140	Air	0.4	Au
ssz716	3119 w/ 3365 200 mg/L	140	Air	0.6	Au
pz413	3119 w/ 3362 200 mg/L	140	Air	0.4	Au
ssz717	3119 w/ 3357 200 mg/L	140	Air	0.5	Au
pz414	3119 w/ 3366 200 mg/L	140	Air	0.3	Au
pz415	100 µL HMDS after SPE 3084	140	Air	4.3	Au
ssz718	2827 w/ 3407 200 mg/L	140	Air	0.8	Au
pz416	2827 w/ 3408 200 mg/L	140	Air	0.9	Au
pz417	SPE 3084 (w/ SPE C7 Prep.)	140	Air	10.2	Au
pz418	SPE 3084 (w/ SPE C7 Prep.)	140	Air	3.8	Au
pz419	2980 w/ 100 µL BSA	140	Air	1.7	Au
ssz720	2747	140	Air	0.5	Au
ssz719	2980	140	Air	0.9	Au
pz420	2980 w/ 400 µL HMDS	140	Air	0.8	Au
ssz721	3419 - JP8 - Kirtland AFB	140	Air	1.9	Au
pz421	3423 - JP8 - GE	140	Air	2.6	Au
ssz722	3420 - JP8+100 - Kirtland AFB	140	Air	0.8	Au
ssz723	2985	140	Air	8.0	Au
pz422	POSF-3411	140	Air	0.5	Au
ssz724	POSF-3412	140	Air	8.7	Au
pz423	POSF-3428	140	Air	4.3	Au
pz424	3428 w/ AO-30 25.75 mg/L	140	Air	1.3	Au

Table 1. List of QCM Experiments (continued)

Run Number	Fuel and Additives	Temperature (C)	Gas	Deposition at 15 Hours ($\mu g/cm^2$)	Electrode Material
ssz725	3428 w/ AO-29 25.65 mg/L	140	Air	5.2	Au
ssz726	POSF-3430	140	Air	4.8	Au
pz425	3428 w/ AO-23 25 mg/L	140	Air	5.4	Au
pz426	3428 w/ AO-31 25.65 mg/L	140	Air	1.4	Au
pz427	3428 w/ AO-32 26.05 mg/L	140	Air	1.2	Au
ssz727	POSF-3430	140	Air	4.3	Au
pz428	3428 w/ AO-36 24.95 mg/L	140	Air	1.1	Au
pz429	3428 w/ AO-37 25.55 mg/L	140	Air	1.3	Au
pz430	3428 w/ AO-46 24.65 mg/L	140	Air	1.1	Au
pz431	3428 w/ Hitec 4733 25 mg/L	140	Air	0.8	Au
pz432	3428 w/ Hitec 4702 25.9 mg/L	140	Air	0.1	Au

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3. ISOTHERMAL CORROSION OXIDATION TEST DATA

The Isothermal Corrosion Oxidation Tester (ICOT) is a static test that has been used to evaluate the effectiveness of additives in jet fuel (9). The apparatus consists of an aluminum heating block, a temperature controller, and a flow controller. In a typical run a 100 mL fuel sample is stressed at 180C for 5 hours in a glass test tube with air bubbling through the sample at 1.3 L/hr. After 5 hours the air supply is discontinued and the test tube is removed from the heating block. The next day the sample is filtered through a pre-weighed 1 μm glass microfiber filter. The filter is placed in an oven at 100F for several hours then cooled in a desiccator and re-weighed. The result is reported as milligrams of solids per liter of fuel. The effectiveness of an additive is based on its ability to reduce the amount of deposits collected on the filter. The deposition data for nearly all of the jet fuels and jet fuel blends that were tested between January 1994 and September 1997 are listed in Table 2.

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Table 2. List of ICOT Experiments

Fuels and Additives	**Solids (mg/L)**
2747	5
2799	0
2827	84
2922	104
2926	64
2928	76
2934	346
2936	72
2959	21
2963	409
2976	0
2980	70
2985	755
2827 with AF-114 (POSF-2895) at 100 mg/L	110
2827 with Inhibitor A (POSF-2901) at 100 mg/L	48
2827 with Prochem 3F29 (POSF-2790) at 100 mg/L	77
2827 with Prochem 3F33 (POSF-2903) at 100 mg/L	84
2827 with 3275008C (POSF-3022) at 200 mg/L	157
2827 with 3275008D (POSF-3023) at 100 mg/L	88
2827 with 3275008E (POSF-3024) at 100 mg/L	50
2827 with 3275059B (POSF-3053) at 100 mg/L	68
2827 with 3275059C (POSF-3054) at 100 mg/L	33
2827 with 7R30 (POSF-3007) at 100 mg/L	51
2827 with 8Q400 (POSF-2787) at 10 mg/L	154
2827 with 8Q405 (POSF-2894) at 100 mg/L	7
2922 with 8Q405 at 100 mg/L	160
2926 with 8Q405 at 100 mg/L	82
2928 with 8Q405 at 100 mg/L	78
2934 with 8Q405 at 100 mg/L	421
2936 with 8Q405 at 100 mg/L	100
2959 with 8Q405 at 100 mg/L	0
2963 with 8Q405 at 100 mg/L	180
2980 with 8Q405 at 100 mg/L	38
2985 with 8Q405 at 100 mg/L	772
2827 with 8Q405 and BHT at 100 and 25 mg/L	42
2922 with 8Q405 and BHT at 100 and 25 mg/L	118
2926 with 8Q405 and BHT at 100 and 25 mg/L	45
2928 with 8Q405 and BHT at 100 and 25 mg/L	80

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	**Solids (mg/L)**
2934 with 8Q405 and BHT at 100 and 25 mg/L	177
2936 with 8Q405 and BHT at 100 and 25 mg/L	105
2959 with 8Q405 and BHT at 100 and 25 mg/L	2
2963 with 8Q405 and BHT at 100 and 25 mg/L	124
2980 with 8Q405 and BHT at 100 and 25 mg/L	3
2985 with 8Q405 and BHT at 100 and 25 mg/L	901
2827 with 8Q405 and Exxon #12 (POSF-2843) at 100 and 25 mg/L	22
2922 with 8Q405 and Exxon #12 at 100 and 25 mg/L	109
2926 with 8Q405 and Exxon #12 at 100 and 25 mg/L	44
2963 with 8Q405 and Exxon #12 at 100 and 25 mg/L	150
2980 with 8Q405 and Exxon #12 at 100 and 25 mg/L	11
2827 with 8Q405 (70%) and 8Q400 (30%) at 100 mg/L	13
2922 with 8Q405 (70%) and 8Q400 (30%) at 100 mg/L	80
2980 with 8Q405 (70%) and 8Q400 (30%) at 100 mg/L	8
2827 with 8Q405 (70%), 8Q400 (20%) and 3F29 (10%) at 100 mg/L	11
2922 with 8Q405 (70%), 8Q400 (20%) and 3F29 (10%) at 100 mg/L	103
2980 with 8Q405 (70%), 8Q400 (20%) and 3F29 (10%) at 100 mg/L	29
2922 with 7R30 (POSF-3007) at 100 mg/L	127
2926 with 7R30 at 100 mg/L	52
2928 with 7R30 at 100 mg/L	83
2934 with 7R30 at 100 mg/L	119
2936 with 7R30 at 100 mg/L	79
2959 with 7R30 at 100 mg/L	32
2963 with 7R30 at 100 mg/L	363
2980 with 7R30 at 100 mg/L	37
2827 with FOA-2A (POSF-2912) at 50 mg/L	80
2827 with FOA-2 (POSF-2913) at 50 mg/L	94
2827 with FOA-5 (POSF-2914) at 50 mg/L	47
2827 with MDA (POSF-2904) at 10 mg/L	9
2827 with PL-1517 (POSF-2852) at 25 mg/L	108
2827 with PL-1601 (POSF-2853) at 25 mg/L	100
2827 with PL-1602 (POSF-2854) at 25 mg/L	40
2827 with PL-1605 (POSF-2906) at 25 mg/L	17
2827 with PL-1606 (POSF-2907) at 25 mg/L	5
2827 with PL-1607 (POSF-2908) at 25 mg/L	0
2827 with PL-1608 (POSF-2909) at 25 mg/L	14
2827 with PL-1610 (POSF-2910) at 25 mg/L	27
2827 with PL-1614 (POSF-2911) at 25 mg/L	16
2827 with PL-1642 (POSF-2921) at 25 mg/L	8

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	**Solids (mg/L)**
2827 with PL-1700 (POSF-2998) at 15 mg/L	105
2980 with PL-1606 at 25 mg/L	115
2980 with PL-1607 at 25 mg/L	27
2926 with PL-1606 at 25 mg/L	151
2926 with PL-1607 at 25 mg/L	61
2980 with PL-1642 at 25 mg/L	10
2926 with PL-1642 at 25 mg/L	25
2922 with PL-1642 at 25 mg/L	154
2934 with PL-1642 at 25 mg/L	290
2827 with Exxon #12 (POSF-2843) at 25 mg/L	17
2827 with Exxon #14 (POSF-2845) at 100 mg/L	98
2827 with Exxon #15 (POSF-2846) at 100 mg/L	108
2827 with Exxon #16 (POSF-2847) at 100 mg/L	71
2827 with Exxon #17 (POSF-2848) at 100 mg/L	52
2827 with Exxon #18 (POSF-2849) at 100 mg/L	51
2827 with MCP-147B (POSF-2726) at 300 mg/L	0
2827 with MCP-477 (POSF-2727) at 300 mg/L	14
2827 with MCP-750 (POSF-3040) at 300 mg/L	122
2827 with MCP-751 (POSF-3039) at 300 mg/L	119
2827 with MCP-753 (POSF-3043) at 300 mg/L	120
2827 with MCP-758 (POSF-3044) at 300 mg/L	73
2827 with MCP-759 (POSF-3045) at 300 mg/L	125
2827 with MCP-867 (POSF-3041) at 300 mg/L	69
2827 with MCP-873 (POSF-2733) at 300 mg/L	98
2827 with MCP-880 (POSF-3046) at 300 mg/L	69
2827 with MCP-902 (POSF-3038) at 300 mg/L	52
2827 with MCP-1020 (POSF-2735) at 300 mg/L	80
2827 with MCP-1025 (POSF-2732) at 300 mg/L	3
2827 with MCP-1395 (POSF-3042) at 300 mg/L	0
2827 with MCP-1408B (POSF-2940) at 300 mg/L	63
2827 with MCP-1409B (POSF-2943) at 300 mg/L	26
2827 with MCP-1411 (POSF-2950) at 300 mg/L	21
2827 with MCP-1412 (POSF-2945) at 300 mg/L	85
2827 with MCP-1412B (POSF-2949) at 300 mg/L	76
2827 with MCP-1413 (POSF-2946) at 300 mg/L	10
2827 with MCP-1413B (POSF-2947) at 300 mg/L	115
2827 with RT-1694E (POSF-2730) at 300 mg/L	69
2827 with RT-1912 (POSF-2731) at 300 mg/L	37
2827 with RT-1928A (POSF-2728) at 300 mg/L	37

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	**Solids (mg/L)**
2926 with MCP-1020 at 300 mg/L	148
2926 with MCP-1025 at 300 mg/L	129
2926 with MCP-147B at 300 mg/L	10
2926 with RT-1912 at 300 mg/L	128
2926 with MCP-1413 at 300 mg/L	14
2926 with MCP-1020 and 8Q405 at 300 and 100 mg/L	80
2926 with MCP-1025 and 8Q405 at 300 and 100 mg/L	5
2926 with MCP-147B and 8Q405 at 300 and 100 mg/L	2
2926 with RT-1912 and 8Q405 at 300 and100 mg/L	83
2922 with MCP-1020 at 300 mg/L	124
2922 with MCP-1025 at 300 mg/L	159
2922 with MCP-147B at 300 mg/L	145
2922 with RT-1912 at 300 mg/L	143
2922 with MCP-1413 at 300 mg/L	200
2922 with MCP-1020 and 8Q405 at 300 and 100 mg/L	144
2922 with MCP-1025 and 8Q405 at 300 and 100 mg/L	34
2922 with MCP-147B and 8Q405 at 300 and 100 mg/L	76
2922 with RT-1912 and 8Q405 at 300 and100 mg/L	192
2980 with MCP-1020 at 300 mg/L	179
2980 with MCP-1025 at 300 mg/L	10
2980 with MCP-147B at 300 mg/L	39
2980 with RT-1912 at 300 mg/L	109
2980 with MCP-1413 at 300 mg/L	5
2980 with MCP-1020 and 8Q405 at 300 and 100 mg/L	151
2980 with MCP-1025 and 8Q405 at 300 and 100 mg/L	5
2980 with MCP-147B and 8Q405 at 300 and 100 mg/L	2
2980 with RT-1912 and 8Q405 at 300 and100 mg/L	76
2827 with TFA-4650 (POSF-2957) at 0.006% volume	27
2827 with TFA-4681 (POSF-2958) at 0.019% weight	91
2922 with TFA-4650 at 0.006% volume	116
2922 with TFA-4681 at 0.019% weight	148
2934 with TFA-4650 at 0.006% volume	85
2934 with TFA-4681 at 0.019% weight	80
2747 with JFA-5 at 12 mg/L	11
2827 with JFA-5 at 12 mg/L	22
2922 with JFA-5 at 12 mg/L	170
2926 with JFA-5 at 12 mg/L	89
2928 with JFA-5 at 12 mg/L	151
2934 with JFA-5 at 12 mg/L	129

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	Solids (mg/L)
2936 with JFA-5 at 12 mg/L	164
2959 with JFA-5 at 12 mg/L	7
2963 with JFA-5 at 12 mg/L	420
2980 with JFA-5 at 12 mg/L	20
2985 with JFA-5 at 12 mg/L	790
2827 with Diegme at 0.15% volume	168
2827 with Stadis 450 at 2 mg/L	57
2827 with DCI-4A at 9 mg/L	23
2827 with Diegme, Stadis 450 and DCI-4A (JP-8 additives)	142
2922 with Diegme, Stadis 450 and DCI-4A (JP-8 additives)	124
2926 with Diegme, Stadis 450 and DCI-4A (JP-8 additives)	144
2980 with Diegme, Stadis 450 and DCI-4A (JP-8 additives)	198
2827 with JP-8 additives and 8Q405 at 100 mg/L	106
2922 with JP-8 additives and 8Q405 at 100 mg/L	136
2926 with JP-8 additives and 8Q405 at 100 mg/L	95
2980 with JP-8 additives and 8Q405 at 100 mg/L	33
2827 with JP-8 additives, 8Q405 and BHT at 100 and 25 mg/L	6
2922 with JP-8 additives, 8Q405 and BHT at 100 and 25 mg/L	100
2926 with JP-8 additives, 8Q405 and BHT at 100 and 25 mg/L	5
2980 with JP-8 additives, 8Q405 and BHT at 100 and 25 mg/L	5
2827 with 8Q405 and MCP-477 at 100 and 300 mg/L	2
2922 with 8Q405 and MCP-477 at 100 and 300 mg/L	55
2926 with 8Q405 and MCP-477 at 100 and 300 mg/L	66
2928 with 8Q405 and MCP-477 at 100 and 300 mg/L	53
2934 with 8Q405 and MCP-477 at 100 and 300 mg/L	0
2936 with 8Q405 and MCP-477 at 100 and 300 mg/L	6
2959 with 8Q405 and MCP-477 at 100 and 300 mg/L	3
2963 with 8Q405 and MCP-477 at 100 and 300 mg/L	143
2980 with 8Q405 and MCP-477 at 100 and 300 mg/L	0
2827 with 8Q405 and MCP-477 at 50 and 150 mg/L	103
2922 with 8Q405 and MCP-477 at 50 and 150 mg/L	92
2926 with 8Q405 and MCP-477 at 50 and 150 mg/L	90
2928 with 8Q405 and MCP-477 at 50 and 150 mg/L	94
2934 with 8Q405 and MCP-477 at 50 and 150 mg/L	6
2936 with 8Q405 and MCP-477 at 50 and 150 mg/L	22
2959 with 8Q405 and MCP-477 at 50 and 150 mg/L	21
2827 with 8Q405 and MCP-477 at 100 and 150 mg/L	10
2922 with 8Q405 and MCP-477 at 100 and 150 mg/L	138
2926 with 8Q405 and MCP-477 at 100 and 150 mg/L	3

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	**Solids (mg/L)**
2928 with 8Q405 and MCP-477 at 100 and 150 mg/L	15
2934 with 8Q405 and MCP-477 at 100 and 150 mg/L	90
2936 with 8Q405 and MCP-477 at 100 and 150 mg/L	89
2959 with 8Q405 and MCP-477 at 100 and 150 mg/L	3
2959 with 8Q405 and MCP-477 at 100 and 75 mg/L	7
2827 with 8Q405, MCP-477 and BHT at 100, 300 and 25 mg/L	3
2922 with 8Q405, MCP-477 and BHT at 100, 300 and 25 mg/L	162
2926 with 8Q405, MCP-477 and BHT at 100, 300 and 25 mg/L	60
2928 with 8Q405, MCP-477 and BHT at 100, 300 and 25 mg/L	43
2934 with 8Q405, MCP-477 and BHT at 100, 300 and 25 mg/L	2
2936 with 8Q405, MCP-477 and BHT at 100, 300 and 25 mg/L	18
2959 with 8Q405, MCP-477 and BHT at 100, 300 and 25 mg/L	2
2963 with 8Q405, MCP-477 and BHT at 100, 300 and 25 mg/L	131
2980 with 8Q405, MCP-477 and BHT at 100, 300 and 25 mg/L	7
2981 with 8Q405, MCP-477 and BHT at 100, 300 and 25 mg/L	7
2985 with 8Q405, MCP-477 and BHT at 100, 300 and 25 mg/L	777
2827 with 8Q405, MDA and BHT at 100, 10 and 25 mg/L	0
2922 with 8Q405, MDA and BHT at 100, 10 and 25 mg/L	110
2926 with 8Q405, MDA and BHT at 100, 10 and 25 mg/L	0
2928 with 8Q405, MDA and BHT at 100, 10 and 25 mg/L	46
2934 with 8Q405, MDA and BHT at 100, 10 and 25 mg/L	325
2936 with 8Q405, MDA and BHT at 100, 10 and 25 mg/L	0
2959 with 8Q405, MDA and BHT at 100, 10 and 25 mg/L	0
2963 with 8Q405, MDA and BHT at 100, 10 and 25 mg/L	27
2980 with 8Q405, MDA and BHT at 100, 10 and 25 mg/L	0
2985 with 8Q405, MDA and BHT at 100, 10 and 25 mg/L	771
2827 with MCP-147B, MDA and BHT at 300, 10 and 25 mg/L	0
2922 with MCP-147B, MDA and BHT at 300, 10 and 25 mg/L	168
2926 with MCP-147B, MDA and BHT at 300, 10 and 25 mg/L	0
2928 with MCP-147B, MDA and BHT at 300, 10 and 25 mg/L	16
2934 with MCP-147B, MDA and BHT at 300, 10 and 25 mg/L	385
2936 with MCP-147B, MDA and BHT at 300, 10 and 25 mg/L	0
2959 with MCP-147B, MDA and BHT at 300, 10 and 25 mg/L	0
2963 with MCP-147B, MDA and BHT at 300, 10 and 25 mg/L	337
2980 with MCP-147B, MDA and BHT at 300, 10 and 25 mg/L	0
2985 with MCP-147B, MDA and BHT at 300, 10 and 25 mg/L	754
2827 with MCP-147B, MDA and BHT at 100, 10 and 25 mg/L	2
2922 with MCP-147B, MDA and BHT at 100, 10 and 25 mg/L	132
2926 with MCP-147B, MDA and BHT at 100, 10 and 25 mg/L	16

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	Solids (mg/L)
2959 with MCP-147B, MDA and BHT at 300, 10 and 25 mg/L	0
2990	306
2991	262
2992	153
2993	77
2994	348
2995	70
2999	47
3000	386
3001	172
3002	893
3019	658
3020	94
3029	255
3030	175
3031	445
3036	142
3037	81
3047	124
3048	645
3049	4
3061	177
3062	250
3082	34
3083	107
3102	817
3108	184
3109	111
3110	172
2990 with 8Q405 and BHT at 100 and 25 mg/L	138
2990 with 8Q405 and BHT at 100 and 25 mg/L	150
2991 with 8Q405 and BHT at 100 and 25 mg/L	242
2991 with 8Q405 and BHT at 100 and 25 mg/L	165
2992 with 8Q405 and BHT at 100 and 25 mg/L	104
2993 with 8Q405 and BHT at 100 and 25 mg/L	22
2994 with 8Q405 and BHT at 100 and 25 mg/L	67
2995 with 8Q405 and BHT at 100 and 25 mg/L	33
2999 with 8Q405 and BHT at 100 and 25 mg/L	32
3000 with 8Q405 and BHT at 100 and 25 mg/L	172

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	Solids (mg/L)
3001 with 8Q405 and BHT at 100 and 25 mg/L	91
3002 with 8Q405 and BHT at 100 and 25 mg/L	1120
3019 with 8Q405 and BHT at 100 and 25 mg/L	534
3020 with 8Q405 and BHT at 100 and 25 mg/L	52
3029 with 8Q405 and BHT at 100 and 25 mg/L	162
3030 with 8Q405 and BHT at 100 and 25 mg/L	51
3031 with 8Q405 and BHT at 100 and 25 mg/L	217
3036 with 8Q405 and BHT at 100 and 25 mg/L	51
3037 with 8Q405 and BHT at 100 and 25 mg/L	105
3047 with 8Q405 and BHT at 100 and 25 mg/L	44
3048 with 8Q405 and BHT at 100 and 25 mg/L	846
3049 with 8Q405 and BHT at 100 and 25 mg/L	0
3061 with 8Q405 and BHT at 100 and 25 mg/L	115
3062 with 8Q405 and BHT at 100 and 25 mg/L	62
3082 with 8Q405 and BHT at 100 and 25 mg/L	24
3083 with 8Q405 and BHT at 100 and 25 mg/L	56
3102 with 8Q405 and BHT at 100 and 25 mg/L	722
3108 with 8Q405 and BHT at 100 and 25 mg/L	55
3109 with 8Q405 and BHT at 100 and 25 mg/L	98
3110 with 8Q405 and BHT at 100 and 25 mg/L	55
2990 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	7
2991 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	3
2992 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	94
2993 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	1
2994 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	1
2995 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	67
2999 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	4
3000 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	3
3001 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	0
3002 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	330
3019 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	181
3020 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	12
3029 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	1
3030 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	1
3031 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	7
3036 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	1
3037 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	18
3047 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	1
3048 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	93

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	**Solids (mg/L)**
3049 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	0
3061 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	8
3062 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	1
3082 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	2
3083 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	3
3102 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	117
3108 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	1
3109 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	87
3110 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	55
2990 with MCP-147B and BHT at 300 and 25 mg/L	264
2991 with MCP-147B and BHT at 300 and 25 mg/L	248
2990 with MCP-147B, BHT and MDA at 300, 25 and 10 mg/L	5
2991 with MCP-147B, BHT and MDA at 300, 25 and 10 mg/L	5
3037 with MCP-147B and BHT at 300 and 25 mg/L	251
3048 with MCP-147B and BHT at 300 and 25 mg/L	583
3056	190
2922 with MCP-1395 and BHT at 300 and 25 mg/L	0
2926 with MCP-1395 and BHT at 300 and 25 mg/L	126
2985 with MCP-1395 and BHT at 300 and 25 mg/L	830
2827 with SDA-722-1 (POSF-3063)	195
2827 with SDA-722-2 (POSF-3064)	59
2827 with SDA-722-3 (POSF-3065)	74
2827 with SDA-722-4 (POSF-3066)	286
3011	486
3012	707
3056 with 8Q405 and BHT at 100 and 25 mg/L	39
3056 with MCP-147B and BHT at 300 and 25 mg/L	140
2827 with POSF-3054 at 100 mg/L	68
2827 with POSF-3055 at 100 mg/L	33
3056 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	26
3056 with MCP-147B, BHT and MDA at 300, 25 and 10 mg/L	5
3067	263
3067	284
2980 with 50 ppb copper	361
2980 with 40 ppb copper	202
2980 with 30 ppb copper	245
2980 with 20 ppb copper	155
2980 with 10 ppb copper	114
2990 with MDA at 10 mg/L	20

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	Solids (mg/L)
2827 with PL-1707 (POSF-3068) at 125 mg/L	10
2827 with PL-1708 (POSF-3069) at 112.5 mg/L	12
2827 with PL-1709 (POSF-3070) at 392 mg/L	4
2827 with PL-1710 (POSF-3071) at 87 mg/L	4
2827 with PL-1711 (POSF-3072) at 235 mg/L	4
2827 with PL-1712 (POSF-3073) at 308 mg/L	4
2827 with PL-1713 (POSF-3074) at 125 mg/L	36
2827 with PL-1714 (POSF-3075) at 123 mg/L	35
2827 with PL-1715 (POSF-3076) at 135 mg/L	4
2980 with PL-1709 (POSF-3070) at 392 mg/L	11
2980 with PL-1710 (POSF-3071) at 87 mg/L	15
2980 with PL-1711 (POSF-3072) at 235 mg/L	10
2980 with PL-1712 (POSF-3073) at 308 mg/L	8
2980 with PL-1715 (POSF-3076) at 135 mg/L	12
2926 with PL-1709 (POSF-3070) at 392 mg/L	7
2926 with PL-1710 (POSF-3071) at 87 mg/L	20
2827 with MCP-1309 (POSF-3077) at 300 mg/L	0
2827 with MCP-1521 (POSF-3078) at 300 mg/L	0
2980 with MCP-1309 at 300 mg/L	0
2980 with MCP-1521 at 300 mg/L	0
2985 with MCP-1309 and BHT at 300 and 25 mg/L	855
2985 with MCP-1521 and BHT at 300 and 25 mg/L	800
2827 with POSF-3095 at 27 mL/L	5
2827 with POSF-3091 at 27 mL/L	4
2827 with POSF-3094 at 27 mL/L	4
2827 with 8Q405-1591 at 100 mg/L	1
2827 with 8Q405-1641 at 100 mg/L	18
2827 with 8Q405-1671 at 100 mg/L	6
2827 with 8Q405-1571 at 100 mg/L	9
2827 with 8Q405-1621 at 100 mg/L	8
2827 with 8Q405-1651 at 100 mg/L	40
2827 with POSF-3090 at 27 mL/L	3
2827 with POSF-3091 at 27 mL/L	4
2827 with POSF-3092 at 27 mL/L	40
2827 with POSF-3093 at 27 mL/L	7
2827 with POSF-3094 at 27 mL/L	4
2827 with POSF-3095 at 27 mL/L	5
2827 with POSF-3096 at 27 mL/L	2
2827 with POSF-3097 at 27 mL/L	14

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	**Solids (mg/L)**
2827 with 8Q406 at 125 mg/L	18
2980 with 8Q406 at 125 mg/L	6
2926 with 8Q406 at 125 mg/L	48
2827 solid phase extracted	178
2827 solid phase extracted	190
2827	53
2980 with 8Q405-1591 and BHT at 100 and 25 mg/L	2
2926 with 8Q405-1591 and BHT at 100 and 25 mg/L	10
2827 with 8Q405-1591 and BHT at 100 and 25 mg/L	6
2827 with VX-4013 (POSF-3086) at 25 mg/L	32
2827 with VX-4973 (POSF-3088) at 25 mg/L	70
2827 with VX-4139 (POSF-3087) at 25 mg/L	53
2827 with PL-1707 (POSF-3068) at 125 mg/L	4
2827 with PL-1709 (POSF-3070) at 392 mg/L	2
2827 with PL-1710 (POSF-3071) at 87 mg/L	2
2827 with PL-1713 (POSF-3074) at 125 mg/L	47
2827 with MCP-1521 (POSF-3078) at 150 mg/L	2
2980 with PL-1712 (POSF-3073) at 308 mg/L	2
3098	0
3099	120
3100	103
3101	111
3098 with 8Q405 and 8Q203 at 100 and 70 mg/L	0
3098 with 8Q405 and BHT at 100 and 25 mg/L	0
2827 with ILFC 1002 (POSF-3107) at 125 mg/L	20
2926 with PL-1709 (POSF-3070) at 392 mg/L	7
2926 with PL-1710 (POSF-3071) at 87 mg/L	20
2926 with MCP-1521 (POSF-3078) at 150 mg/L	15
2980 with MCP-1521 at 150 mg/L	2
2962	179
2962 with 8Q405 and BHT at 100 and 25 mg/L	84
2962 with 8Q405, BHT and MDA at 100, 25 and 2 mg/L	7
2962 with 8Q405, BHT and MDA at 100, 25 and 5 mg/L	11
2962 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	23
2963	300
2963 with 8Q405 and BHT at 100 and 25 mg/L	158
2963 with 8Q405, BHT and MDA at 100, 25 and 2 mg/L	52
2963 with 8Q405, BHT and MDA at 100, 25 and 5 mg/L	50
2963 with 8Q405, BHT and MDA at 100, 25 and 10 mg/L	20

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	Solids (mg/L)
2934	48
2827 with POSF-3111 at 144 mg/L	6
2827 with POSF-3112 at 135 mg/L	4
2827 with POSF-3113 at 160 mg/L	10
2827	67
2827 with POSF-3114 at 160 mg/L	16
2827 with POSF-3115 at 160 mg/L	10
2827 with POSF-3116 at 145 mg/L	45
2827 with POSF-3117 at 135 mg/L	15
2827 with MCP-1521, BHT and MDA at 150, 25 and 2 mg/L	3
2926 with MCP-1521, BHT and MDA at 150, 25 and 2 mg/L	12
2980 with MCP-1521, BHT and MDA at 150, 25 and 2 mg/L	6
2962 with 8Q406 at 125 mg/L	172
3084	55
3084 with 8Q405 and BHT at 100 and 25 mg/L	53
3110	172
3109	111
3108	184
3102	817
3083	107
3084 with 8Q405, BHT and MDA at 100, 25 and 2 mg/L	7
3082 with 8Q405 and BHT at 100 and 25 mg/L	24
3083 with 8Q405 and BHT at 100 and 25 mg/L	56
3102 with 8Q405 and BHT at 100 and 25 mg/L	722
3108 with 8Q405 and BHT at 100 and 25 mg/L	55
3109 with 8Q405 and BHT at 100 and 25 mg/L	98
3110 with 8Q405 and BHT at 100 and 25 mg/L	55
3082 with 8Q405, BHT and MDA at 100, 25 and 2 mg/L	2
3083 with 8Q405, BHT and MDA at 100, 25 and 2 mg/L	3
3102 with 8Q405, BHT and MDA at 100, 25 and 2 mg/L	117
3108 with 8Q405, BHT and MDA at 100, 25 and 2 mg/L	1
3109 with 8Q405, BHT and MDA at 100, 25 and 2 mg/L	87
3110 with 8Q405, BHT and MDA at 100, 25 and 2 mg/L	55
2827 with MCP-147B, BHT and MDA at 150, 25 and 2 mg/L	4
2926 with MCP-147B, BHT and MDA at 150, 25 and 2 mg/L	10
2980 with MCP-147B, BHT and MDA at 150, 25 and 2 mg/L	5
3082 with MCP-147B, BHT and MDA at 150, 25 and 2 mg/L	34
2926 with POSF-3096 at 5 mL/L	47
2980 with POSF-3096 at 5 mL/L	83

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	**Solids (mg/L)**
2926 with POSF-3096 at 10 mL/L	60
2926 with POSF-3096 at 20 mL/L	4
2980 with POSF-3096 at 10 mL/L	1
2980 with POSF-3096 at 20 mL/L	1
2926 with POSF-3096 at 27 mL/L	9
2980 with POSF-3096 at 27 mL/L	3
3119	55
3123	85
3122	81
2827 with Mobile Blend 2 at 437.5 mg/L	23
2827 with Mobile Blend 3 at 500 mg/L	5
2827 with POSF-3124 at 160 mg/L	4
2827 with POSF-3125 at 160 mg/L	66
2827 with POSF-3126 at 160 mg/L	70
2827 with POSF-3127 at 160 mg/L	50
2827 with POSF-3128 at 190 mg/L	25
2827 with POSF-3129 at 190 mg/L	1
3131	90
3132	102
3134	58
3135	71
3139	230
2926 with POSF-3124 at 160 mg/L	34
2926 with POSF-3129 at 160 mg/L	27
3084 with POSF-3124 at 160 mg/L	37
3084 with POSF-3129 at 160 mg/L	8
2747 with MCP-1750 at 438 mg/L	0
2747 with MCP-1750 and 8Q406 at 220 and 65 mg/L	0
2827 with MCP-1750 at 438 mg/L	10
3119 with MCP-1750 at 438 mg/L	31
2747 with 8Q406 at 125 mg/L	0
2827 with 8Q406 at 125 mg/L	30
3119 with 8Q406 at 125 mg/L	54
2827 with 8Q406 and MCP-1750 at 65 and 220 mg/L	14
3119 with 8Q406 and MCP-1750 at 65 and 220 mg/L	34
3145 with 8Q406 at 125 mg/L	700
3145 with 8Q406 and MDA at 125 and 2 mg/L	410
3145	831
2827 with POSF-3154 at 190 mg/L	3

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	**Solids (mg/L)**
2827 with POSF-3155 at 190 mg/L	5
2827 with POSF-3156 at 190 mg/L	5
2827 with POSF-3157 at 190 mg/L	0
2827 with 8Q460 at 127 mg/L	3
2827 with POSF-3177 at 100 mg/L	26
2827 with POSF-3172 at 125 mg/L	24
2827 with POSF-3171 at 125 mg/L	24
2827 with POSF-3180 at 120 mg/L	110
2827 with POSF-3181 at 120 mg/L	76
2827 with POSF-3182 at 150 mg/L	10
2827 with POSF-3183 at 120 mg/L	39
2827 with POSF-3184 at 120 mg/L	58
2827 with POSF-3185 at 120 mg/L	53
2827 with POSF-3186 at 100 mg/L	102
2827 with POSF-3187 at 100 mg/L	12
2827 with POSF-3188 at 100 mg/L	3
2827 with POSF-3189 at 120 mg/L	7
2827 with POSF-3190 at 150 mg/L	18
2827 with POSF-3191 at 150 mg/L	13
2827 with PL-1733 (POSF-3192) at 100 mg/L	49
2827 with PL-1734 (POSF-3193) at 100 mg/L	72
2827 with PL-1735 (POSF-3194) at 100 mg/L	63
2827 with PL-1736 (POSF-3195) at 100 mg/L	50
2827 with PL-1737 (POSF-3196) at 100 mg/L	60
2827 with PL-1738 (POSF-3197) at 100 mg/L	43
2827 with PL-1739 (POSF-3198) at 100 mg/L	74
2827 with PL-1740 (POSF-3199) at 100 mg/L	6
2827 with PL-1741 (POSF-3200) at 100 mg/L	68
2827 with PL-1742 (POSF-3201) at 100 mg/L	70
2827 with VX-4973 (POSF-3088) at 125 mg/L	94
2827 with NEL-75-38 (POSF-3203) at 125 mg/L	50
2827 with NEL-75-37 (POSF-3202) at 150 mg/L	4
2827 with POSF-3179 at 10 g/L	116
2827 with 8Q405, MDA and AO#31 at 100, 2 and 25 mg/L	1
3119 with POSF-3114, BHT and MDA at 160, 25 and 2 mg/L	53
3119 with POSF-3114 and BHT at 160 and 25 mg/L	50
2827 with POSF-3114, BHT and MDA at 160, 25 and 2 mg/L	20
2827 with POSF-3114 and BHT at 160 and 25 mg/L	19
2926 with POSF-3114 and BHT at 160 and 25 mg/L	42

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	**Solids (mg/L)**
2827 with POSF-3096, BHT and MDA at 627 mg/L	10
2926 with POSF-3096, BHT and MDA at 627 mg/L	16
3119 with POSF-3096, BHT and MDA at 627 mg/L	59
2827 with POSF-3096 at 600 mg/L	78
3119 with POSF-3096 at 600 mg/L	81
2926 with POSF-3096 at 600 mg/L	156
2926 with POSF-3114, BHT and MDA at 160, 25 and 2 mg/L	53
2827 with POSF-3111, BHT and MDA at 144, 25 and 2 mg/L	3
3119 with POSF-3111, BHT and MDA at 144, 25 and 2 mg/L	60
2926 with POSF-3111, BHT and MDA at 144, 25 and 2 mg/L	20
2926 with POSF-3096 at 627 mg/L	156
2827 with POSF-3111 and BHT at 144 and 25 mg/L	3
2926 with POSF-3111 and BHT at 144 and 25 mg/L	72
3119 with POSF-3111 and BHT at 144 and 25 mg/L	81
2926 with POSF-3171 at 125 mg/L	72
3119 with POSF-3171 at 125 mg/L	84
3229	6
3230	100
3232	100
3233	7
3234	90
3235	30
3119	65
3119 with PL-1740 (POSF-3199) at 100 mg/L	75
3119 with PL-1740 and BHT at 100 and 25 mg/L	90
3119 with PL-1740, BHT and MDA at 100, 25 and 2 mg/L	53
3242	157
3243	41
2926	96
2926 with PL-1740 at 100 mg/L	36
2926 with PL-1740 and BHT at 100 and 25 mg/L	71
2926 with PL-1740, BHT and MDA at 100, 25 and 2 mg/L	39
2827	140
2827 with PL-1740 and BHT at 100 and 25 mg/L	50
2827 with PL-1740, BHT and MDA at 100, 25 and 2 mg/L	5
2827 with POSF-3186 at 100 mg/L	55
2827 with POSF-3237 at 165 mg/L	21
2827 with POSF-3238 at 165 mg/L	8
2827 with POSF-3239 at 165 mg/L	1

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	**Solids (mg/L)**
2827 with POSF-3241 at 165 mg/L	10
2827 with 8Q462 at 256 mg/L	8
2827 with POSF-3240 at 165 mg/L	40
2827 with POSF-3182, BHT and MDA at 150, 25 and 2 mg/L	1
2827 with POSF-3188, BHT and MDA at 150, 25 and 2 mg/L	4
2827 with POSF-3190, BHT and MDA at 150, 25 and 2 mg/L	2
2827 with POSF-3245 at 150 mg/L	9
2827 with POSF-3246 at 150 mg/L	41
2827 with POSF-3247 at 150 mg/L	51
2827 with POSF-3248 at 150 mg/L	45
2827 with POSF-3249 at 100 mg/L	126
2926 with 8Q462 at 256 mg/L	22
3119 with 8Q462 at 256 mg/L	63
2926 with POSF-3157 at 190 mg/L	93
3084 with POSF-3157 at 190 mg/L	61
3119 with POSF-3157 at 190 mg/L	34
3084	86
2827 with POSF-3171, BHT and MDA at 125, 25 and 2 mg/L	8
2926 with POSF-3171, BHT and MDA at 125, 25 and 2 mg/L	60
3119 with POSF-3202 at 150 mg/L	67
3259	192
3260	105
3261	91
3265	134
3266	136
3267	158
3268	221
3119 with POSF-3171, BHT and MDA at 125, 25 and 2 mg/L	79
2926 with POSF-3202 at 150 mg/L	10
2827 with 8Q405, MDA and AO#24 at 100, 2 and 10 mg/L	20
2926 with 8Q405, MDA and AO#24 at 100, 2 and 10 mg/L	43
3084 with 8Q405, MDA and AO#24 at 100, 2 and 10 mg/L	28
3119 with 8Q405, MDA and AO#24 at 100, 2 and 10 mg/L	54
2827 with MCP-1750B at 962 mg/L	2
2926 with MCP-1750B at 962 mg/L	6
3119 with MCP-1750B at 962 mg/L	4
3084 with MCP-1750B at 962 mg/L	3
2827 with MCP-1750C at 505 mg/L	4
2926 with MCP-1750C at 505 mg/L	69

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	**Solids (mg/L)**
3119 with MCP-1750C at 505 mg/L	61
3084 with MCP-1750C at 505 mg/L	7
2827 with POSF-3244 at 1.0 weight %	93
2827 with POSF-3262 at 0.6 weight %	193
2827 with POSF-3263 at 160 mg/L	7
2827 with POSF-3182, AO#24 and MDA at 150, 10 and 2 mg/L	7
2827 with POSF-3188, AO#24 and MDA at 100, 10 and 2 mg/L	15
2827 with POSF-3190, AO#24 and MDA at 150, 10 and 2 mg/L	5
2926 with POSF-3245 at 150 mg/L	65
3084 with POSF-3245 at 150 mg/L	57
3119 with POSF-3245 at 150 mg/L	83
3272	253
3273	114
3284	171
3278	88
3279	359
3280	270
3281	213
2926 with POSF-3263 at 160 mg/L	54
3084 with POSF-3263 at 160 mg/L	52
3119 with POSF-3263 at 160 mg/L	92
2827 with PL-1746 (POSF-3270) at 293 mg/L	10
2827 with PL-1747 (POSF-3271) at 458 mg/L	7
3182 with 8Q462 at 256 mg/L	3
2926 with POSF-3182 at 150 mg/L	15
2926 with POSF-3188 at 100 mg/L	47
2926 with POSF-3190 at 150 mg/L	11
3084 with POSF-3182 at 150 mg/L	33
3084 with POSF-3188 at 100 mg/L	40
3084 with POSF-3190 at 150 mg/L	3
3119 with POSF-3182 at 150 mg/L	8
3119 with POSF-3188 at 100 mg/L	5
3119 with POSF-3190 at 150 mg/L	4
2926 with POSF-3239 at 165 mg/L	44
3119 with POSF-3239 at 165 mg/L	43
3084 with POSF-3239 at 165 mg/L	31
2926 with POSF-3241 at 165 mg/L	35
3119 with POSF-3241 at 165 mg/L	7
3084 with POSF-3241 at 165 mg/L	6

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	Solids (mg/L)
3285	200
3286	2
2827 with POSF-3274 at 236 mg/L	23
2827 with POSF-3275 at 251 mg/L	25
2827 with POSF-3276 at 256 mg/L	10
2827 with POSF-3177 at 100 mg/L	93
2827 with POSF-3291 at 160 mg/L	13
2827 with POSF-3292 at 160 mg/L	6
2827 with POSF-3293 at 180 mg/L	87
2827 with POSF-3294 at 180 mg/L	5
3119	82
3119 with POSF-3291 at 160 mg/L	65
2827	30
3119 with POSF-3300 at 160 mg/L	3
3119 with POSF-3301 at 160 mg/L	3
3119 with POSF-3302 at 200 mg/L	44
3119 with POSF-3303 at 200 mg/L	8
2827 with POSF-3262 and 8Q462 at 0.6 weight % and 256 mg/L	34
2827 with POSF-3304 at 100 mg/L	190
2827 with POSF-3300 at 160 mg/L	0
2926 with POSF-3300 at 160 mg/L	13
3084 with POSF-3300 at 160 mg/L	9
2827 with POSF-3301 at 160 mg/L	5
2926 with POSF-3301 at 160 mg/L	14
3084 with POSF-3301 at 160 mg/L	1
2827 with POSF-3303 at 200 mg/L	1
2926 with POSF-3303 at 200 mg/L	12
3084 with POSF-3303 at 200 mg/L	1
2827 with POSF-3306 at 26 mL/L	0
2827 with POSF-3307 at 26 mL/L	0
3119 with POSF-3295 at 327 mg/L	9
2926 with PL-1747 (POSF-3271) at 458 mg/L	4
3119 with PL-1747 (POSF-3271) at 458 mg/L	3
2827 with POSF-3203, BHT and MDA at 125, 25 and 2 mg/L	3
3119 with POSF-3292 at 160 mg/L	0
3119 with POSF-3294 at 180 mg/L	6
3119 with POSF-3171, BHT and MDA at 125, 25 and 2 mg/L	1
3119	165
2827	52

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	**Solids (mg/L)**
2926	81
3322	78
3323	50
2827	74
2827 with POSF-3310 at 26 mL/L	35
2827 with POSF-3311 at 26 mL/L	99
2827 with POSF-3312 at 26 mL/L	187
2827 with POSF-3313 at 26 mL/L	111
2827 with POSF-3314 at 26 mL/L	14
2827 with POSF-3315 at 26 mL/L	12
2827 with POSF-3316 at 26 mL/L	49
2827 with POSF-3317 at 26 mL/L	28
2827 with POSF-3318 at 26 mL/L	3
2827 with POSF-3319 at 26 mL/L	51
2827 with POSF-3320 at 26 mL/L	153
2827 with POSF-3321 at 26 mL/L	57
2827 with POSF-3308 at 100 mg/L	60
2827 with POSF-3309 at 100 mg/L	14
3273	60
3272	179
3289	92
3288	92
3305A (Copper doped)	368
2827 with POSF-3345 at 160 mg/L	0
2827 with POSF-3346 at 160 mg/L	2
2827 with POSF-3308, BHT and MDA at 100, 25 and 2 mg/L	4
2827 with POSF-3309, BHT and MDA at 100, 25 and 2 mg/L	3
3119 with POSF-3307 at 26 mL/L	5
3119 with POSF-3271 at 458 mg/L	0
2926 with POSF-3271 at 458 mg/L	141
2926 with POSF-3308, BHT and MDA at 100, 25 and 2 mg/L	37
2926 with POSF-3309, BHT and MDA at 100, 25 and 2 mg/L	3
3119 with POSF-3308, BHT and MDA at 100, 25 and 2 mg/L	53
3119 with POSF-3309, BHT and MDA at 100, 25 and 2 mg/L	3
3350	8
3352	92
3322	197
2985	1398
3351	183

Table 2: List of ICOT Experiments (continued)

Fuels and Additives	**Solids (mg/L)**
3352	147
3326	62
3353	56
3325	95
2976	46
2827 with POSF-3357 at 200 mg/L	0
2827 with POSF-3358 at 200 mg/L	1
2827 with POSF-3359 at 200 mg/L	2
2827 with POSF-3360 at 200 mg/L	4
2827 with POSF-3361 at 200 mg/L	0
2827 with POSF-3362 at 200 mg/L	0
2827 with POSF-3363 at 200 mg/L	4
2827 with POSF-3365 at 200 mg/L	3
2827 with POSF-3366 at 200 mg/L	5
2827 with PL-1755 (POSF-3367) at 458 mg/L	1
2827 with PL-1756 (POSF-3368) at 229 mg/L	2
2827 with PL-1757 (POSF-3369) at 229 mg/L	3
2827 with PL-1758 (POSF-3370) at 229 mg/L	0
2827 with PL-1759 (POSF-3371) at 229 mg/L	0
2827 with PL-1760 (POSF-3372) at 305 mg/L	5
2827 with PL-1761 (POSF-3373) at 305 mg/L	80
2827 with PL-1762 (POSF-3374) at 229 mg/L	8
2827 with PL-1763 (POSF-3375) at 229 mg/L	10
2827 with PL-1764 (POSF-3376) at 229 mg/L	5
2827 with PL-1765 (POSF-3377) at 305 mg/L	8
2827 with PL-1766 (POSF-3378) at 229 mg/L	2
3352	72
3352	50
3392	26
3391	314
3296	105
3349	168
3328	247
3343	17
3342	198
3324	4
3389	386
3390	258
3397	3

4. PHOENIX RIG DATA

The Phoenix Rig was a flowing system developed by UDRI and used for the study of jet fuel thermal and oxidative stabilities (10). Fuel was pumped at relatively high pressure (up to 3.45 MPa) through stainless-steel tubing held within copper blocks that were used for both the heating and cooling of jet fuel. For heating, the copper blocks contained internal heating elements. For cooling, passages were machined within the copper blocks through which either water or air passed. Bulk fuel temperatures up to 625C and Reynolds numbers up to 11,000 could be attained. As found in actual aircraft, the oxygen availability was limited, and the oxygen concentration was measured at three different locations by gas chromatography. In addition, the mass of surface deposits were measured by carbon burnoff analysis. The Phoenix Rig was used for additive evaluation and fundamental studies of fuel oxidation and surface deposition. The capabilities of dissolved oxygen, deposition, and temperature measurement were extremely fruitful in the development of global (10-14) and pseudo-detailed chemical kinetic models (15, 16) for computational fluid dynamics simulations.

Several JP-8+100 additive candidates were tested using the Phoenix Rig (13, 17) with some results presented in a series of technical reports (18, 19). The Phoenix Rig was also used in the development of an on-line technique to measure dissolved oxygen concentration in a flowing system (20) and in the testing of coatings designed to reduce deposition.

Normal testing consisted of two general types of tests, deposition and oxygen consumption. Phoenix rig test name coding is described in Table 3. Table 4 contains a list of deposition experiments performed on the Phoenix Rig. The table lists the file code name, the fuel number, the flow rate, block temperature, test duration, sparge gas mixture, bulk outlet temperature, total carbon for the heating & cooling sections, additive names. Table 5 contains a list of oxygen experiments performed on the Phoenix Rig. The table lists the file code name, the fuel number & additive, the flow rate, block temperature, sparge gas mixture, bulk outlet temperature, and the amount of dissolved oxygen consumed.

Fuel and additive numbers (POSF codes) are assigned by the Fuels Branch of the Fuels and Lubrication Division of Wright Laboratory (WL/POSF), WPAFB, OH:

JP-8 additives here are DCI4A, Stadis 450, and DiEGME

DCI4A is a corrosion inhibitor/lubricity enhancer

Stadis 450 is a static charge inhibitor

DiEGME inhibits ice formation

Betz 8Q405 is a proprietary detergent-dispersant

Mobil 147B is a proprietary detergent-dispersant

BHT is an antioxidant

MDA is a metal deactivator

Mobil MCP-477 is a proprietary detergent

Table 3. Phoenix Rig Test Name Code

TEST TYPE:	D = DEPOSITION TEST O = OXYGEN DEPLETION TEST		
FUEL IDENTIFICATION:	1 = POSF-2747 2 = POSF-2799 3 = POSF-2827 4 = POSF-2926 5 = POSF-2827 + DCI4A + S-450 + DiEGME	6 = POSF-2980 7 = POSF- 3119 8 = POSF- 9 = POSF-2976 (JPTS)	
ADDITIVE IDENTIFICATION: A = JP8 + M 147B + BHT + MDA B = JP8+8Q405+BHT+MDA C = 8Q405 + MCP477 + BHT. D = JP8 + 8Q405 + BHT . E = ANTIOXIDANT "C" F = 8Q405 + BHT G = Triphenylphosphine	H = JP8+BHT J = JFA-5 K=JP8+BHT+MDA L =NA M = METAL DEACTIVATOR N = NONE O = ANTIOXIDANT "B"	P = DCI4A+STADIS 450+DiEGME Q =NA R = Betz 8Q405 @ 100 mg/L S = P+R= (JP8 + 8Q405) T = ANTIOXIDANT "A"	
TEST TEMPERATURE: (DIVIDE TEMPERATURE BY 10 AND ROUND OFF)	23 = 227 C 27 = 270 C 30 = 300 C V = VARIABLE (AS IN OXYGEN DEPLETION TESTS)		
TEST DURATION (HRS):	2 = 6 HOURS 3 = 8 HOURS 4 = 12 HOURS 8 = 24 HOURS OMIT FOR OXYGEN DEPLETION TEST	(DIVIDE HOURS BY 3 AND ROUND OFF)	
SPARGE GAS:	A = AIR OR NITROGEN/OXYGEN EQUIVALENT N = NITROGEN P = PARTIAL OXYGEN		
REPEAT TESTS:	1 = FIRST 2 = SECOND 3 = THIRD ETC		

EXAMPLES:

D1N574A3	O3JVA1
D = DEPOSITION TEST	O = OXY. DEPLETION TEST
1 = FUEL POSF-2747	3 = FUEL POSF 2827
N = NO ADDITIVE	J = ADDITIVE JFA-5
57 = 573 K TEST TEMPERATURE	V = VARIABLE TEST TEMPERATURE
4 = 12 HOUR DURATION	A = AIR SPARGE
A = AIR SPARGED	1 = FIRST TEST
3 = THIRD TEST OF THIS TYPE	

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Table 4. Phoenix Rig Deposition Tests

Test Name	Fuel	Flow Rate (ml/min)	Block Temp. C	Test Duration (hrs)	Purge Gas Mixture % Oxygen of Total Volume	Bulk Out Temp. C	Heated Section Total Carbon (micrograms)	Cooled Section Total Carbon (micrograms)	Additives*
d1n542a4	posf2747	16	270	6	21%	237	1632	165	NA
d1n542a5	posf2747	16	270	6	21%	NA	638	329	NA
d1n572a2	posf2747	16	300	6	21%	272	1279	155	NA
d1n572a3	posf2747	16	300	6	21%	272	998	99	NA
d1n572a4	posf2747	16	300	6	21%	NA	701	163	NA
d1n572p1	posf2747	16	300	6	21%	272	2548	110	NA
d1n572p2	posf2747	16	300	6	3%	268	1952	90	NA
d1n572p3	posf2747	16	300	6	3%	272	1338	137	NA
d1n512a1	posf2747	16	240	6	AIR	218	123	103	NA
d1n512a2	posf2747	4	240	6	AIR	224	118	107	NA
d1n522a1	posf2747	16	250	6	AIR	228	132	132	NA
d1n542a6	posf2747	16	270	6	AIR	245	163	146	NA
d1n542a7	posf2747	16	270	6	AIR	246	102	111	NA
d1n562a1	posf2747	16	285	6	AIR	258	150	120	NA
d1n572a5	posf2747	16	300	6	AIR	265	442	119	NA
d1n572a6	posf2747	16	300	6	AIR	271	221	95	NA
d3n234a1	posf2827	4	227	12	AIR	210	198	356	NA
d3n234a2	posf2827	4	227	12	AIR	201	204	222	NA
d3n2716a	posf2827	32	270	48	AIR	NA	20400	63970	NA
d3n272a1	posf2827	16	270	6	AIR	245	659	2299	NA
d3n272a2	posf2827	16	270	6	AIR	251	751	1933	NA
d3n272a3	posf2827	16	270	6	AIR	247	767	2230	NA
d3n302a1	posf2827	16	300	6	AIR	277	2140	288	NA
d3n302a2	posf2827	16	300	6	AIR	237	3223	587	NA
d3n302a3	posf2827	16	300	6	AIR	255	3960	355	NA
d3n302a4	posf2827	16	300	6	AIR	276	2288	220	NA
d3n302a5	posf2827	16	300	6	AIR	275	2094	63	NA
d3n302a6	posf2827	16	300	6	AIR	NA	2152	96	NA
d4n234a2	posf2926	4	227	12	AIR	199	445	55	NA
d4n234a3	posf2926	4	227	12	AIR	199	470	70	NA
d4n272a4	posf2926	16	270	6	AIR	245	876	109	NA
d4n302a4	posf2926	16	300	6	AIR	282	1240	71	NA
d4n302a5	posf2926	16	300	6	AIR	277	1579	83	NA
d4n504a1	posf2926	4	227	12	AIR	205	326	91	NA
d4n512a1	posf2926	16	240	6	AIR	223	150	182	NA

Table 4. Phoenix Rig Deposition Tests

Test Name	Fuel	Flow Rate (ml/min)	Block Temp. C	Test Duration (hrs)	Purge Gas Mixture % Oxygen of Total Volume	Bulk Out Temp. C	Heated Section Total Carbon (micrograms)	Cooled Section Total Carbon (micrograms)	Additives*
d4n512a2	posf2926	4	240	6	AIR	226	270	105	NA
d4n522a1	posf2926	16	250	6	AIR	231	216	167	NA
d4n542a1	posf2926	16	270	6	AIR	246	427	117	NA
d4n562a1	posf2926	16	285	6	AIR	255	793	75	NA
d4n572a1	posf2926	16	300	6	AIR	275	695	106	NA
d4n572a2	posf2926	16	300	6	AIR	275	1237	125	NA
d4n572a3	posf2926	16	300	6	AIR	272	1004	149	NA
d4n572p1	posf2926	16	300	6	AIR	273	666	108	NA
d4n572p2	posf2926	16	300	6	6%	275	537	207	NA
d4n572p3	posf2926	16	300	6	3%	272	388	102	NA
d9n234a1	posf2976	4	227	12	AIR	199	137	109	NA
d9n272a1	posf2976	16	270	6	AIR	253	68	56	NA
d9n302a1	posf2976	16	300	6	AIR	282	95	75	NA
d6n224a1	posf2980	4	220	12	AIR	199	411	174	NA
d6n302a1	posf2980	16	300	6	AIR	275	1105	321	NA
d7n242a1	posf3119	16	240	6	AIR	228	781	2476	NA
d7n242p1	posf3119	16	240	6	8%	224	536	910	NA
d7n242p2	posf3119	16	240	6	4%	228	745	470	NA
d7n272a1	posf3119	16	270	6	AIR	255	1420	1673	NA
d7n272p1	posf3119	16	270	6	8%	247	1163	795	NA
d7n272p2	posf3119	16	270	6	4%	NA	1837	302	NA
d7n278a1	posf3119	62	270	24	AIR	223	12395	7233	NA
d7n278p1	posf3119	62	270	24	8%	NA	14885	1176	NA
d7n282a1	posf3119	16	285	6	AIR	246	2531	1538	NA
d7n282p1	posf3119	16	285	6	8%	250	2651	318	NA
d7n302a1	posf3119	16	300	6	AIR	282	3893	482	NA
d7n302p1	posf3119	16	300	6	8%	277	2975	139	NA
d7n302p2	posf3119	16	300	6	4%	NA	2792	124	NA
d5a234a1	posf2827	4	227	12	AIR	195	914	174	JP8 + MOBIL 147B + BHT + MDA
d5a242a1	posf2827	16	240	6	AIR	228	416	416	JP8 + MOBIL 147B + BHT + MDA
d5a272a1	posf2827	16	270	6	AIR	253	1050	171	JP8 + MOBIL 147B + BHT + MDA
d5b234a1	posf2827	4	227	12	AIR	NA	329	1136	JP8 + 8Q405 + BHT + MDA
d5b242a1	posf2827	16	240	6	AIR	NA	248	2104	JP8 + 8Q405 + BHT + MDA
d5b272a1	posf2827	16	270	6	AIR	NA	452	1403	JP8 + 8Q405 + BHT + MDA
d5b278a1	posf2827	62	270	24	AIR	NA	1357	8827	JP8 + 8Q405 + BHT + MDA

Table 4. Phoenix Rig Deposition Tests

Test Name	Fuel	Flow Rate (ml/min)	Block Temp. C	Test Duration (hrs)	Purge Gas Mixture % Oxygen of Total Volume	Bulk Out Temp. C	Heated Section Total Carbon (micrograms)	Cooled Section Total Carbon (micrograms)	Additives*
d5b278p1	posf2827	62	270	24	8%	NA	977	3161	JP8 + 8Q405 + BHT + MDA
d5b278p2	posf2827	62	270	24	4%	NA	625	1856	JP8 + 8Q405 + BHT + MDA
d3c234a1	posf2827	4	227	12	AIR	195	1564	141	8qQ405@100mg/L BHT@25mg/L MCP-477@300mg/L
d3c272a1	posf2827	16	270	6	AIR	241	1985	90	8qQ405@100mg/L BHT@25mg/L MCP-477@300mg/L
d3c302a1	posf2827	16	300	6	AIR	266	3638	276	8qQ405@100mg/L BHT@25mg/L MCP-477@300mg/L
d5p234a1	posf2827	4	227	12	AIR	194	588	1369	JP8 ADDITIVES
d5p272a1	posf2827	16	270	6	AIR	243	2131	284	(DCI-4A, Stadis450, & DiEGME)
d5p302a1	posf2827	16	300	6	AIR	276	5079	100	(DCI-4A, Stadis450, & DiEGME)
d5p302a2	posf2827	16	300	6	AIR	273	5353	160	(DCI-4A, Stadis450, & DiEGME)
d3r234a1	posf2827	4	227	12	AIR	193	148	191	8Q405 @ 100 ml/min
d3r272a1	posf2827	16	270	6	AIR	246	302	1444	8Q405 @ 100 ml/min
d3r302a1	posf2827	16	300	6	AIR	273	796	108	8Q405 @ 100 ml/min
d3r302a2	posf2827	16	300	6	AIR	270	720	163	8Q405 @ 100 ml/min
d5s234a1	posf2827	4	227	12	AIR	189	205	1305	JP8 + 8Q405 @ 100 mg/L
d5s272a1	posf2827	16	270	6	AIR	240	564	2207	JP8 + 8Q405 @ 100 mg/L
d5s302a1	posf2827	16	300	6	AIR	266	1621	111	JP8 + 8Q405 @ 100 mg/L
d5s302a2	posf2827	16	300	6	AIR	NA	1476	89	JP8 + 8Q405 @ 100 mg/L
d4f234a1	posf2926	4	227	12	AIR	199	197	91	8Q405 @ 100 & BHT @ 25 mg/L
d4f272a1	posf2926	16	270	6	AIR	241	265	67	8Q405 @ 100 & BHT @ 25 mg/L
d4f302a1	posf2926	16	300	6	AIR	266	670	56	8Q405 @ 100 & BHT @ 25 mg/L
d4p234a1	posf2926	4	227	12	AIR	190	922	108	JP8
d4p272a1	posf2926	16	270	6	AIR	243	572	88	JP8
d4p302a1	posf2926	16	300	6	AIR	277	1559	79	JP8
d4n302a4	posf2926	16	300	6	AIR	282	1240	71	NONE
d4n302a5	posf2926	16	300	6	AIR	277	1579	83	NONE
d4r234a1	posf2926	4	227	12	AIR	202	162	77	8Q405 @ 100 mg/L
d4r272a1	posf2926	16	270	6	AIR	250	305	67	8Q405 @ 100 mg/L
d4r302a1	posf2926	16	300	6	AIR	271	554	75	8Q405 @ 100 mg/L
d4s234a1	posf2926	4	227	12	AIR	185	312	65	JP8 + 8Q405 @ 100 mg/L
d4s272a1	posf2926	16	270	6	AIR	242	643	76	JP8 + 8Q405 @ 100 mg/L
d4s302a1	posf2926	16	300	6	AIR	271	1184	67	JP8 + 8Q405 @ 100 mg/L
d9n278a1	posf2976	62	270	24	AIR	213	214	155	NONE
d9n278p1	posf2976	62	270	24	8%	211	137	126	NONE
d6b278a1	posf2980	62	270	24	AIR	206	1366	2909	JP8+8Q405+BHT+MDA
d6b278p1	posf2980	62	270	24	8%	205	1177	930	JP8+8Q405+BHT+MDA

Table 4. Phoenix Rig Deposition Tests

Test Name	Fuel	Flow Rate (ml/min)	Block Temp. C	Test Duration (hrs)	Purge Gas Mixture % Oxygen of Total Volume	Bulk Out Temp. C	Heated Section Total Carbon (micrograms)	Cooled Section Total Carbon (micrograms)	Additives*
d6b278p2	posf2980	62	270	24	4%	207	941	608	JP8+8Q405+BHT+MDA
d6b278p3	posf2980	62	270	24	0%	206	330	166	JP8+8Q405+BHT+MDA
d6d234a1	posf2980	NA	227	12	AIR	206	330	166	JP8 + 8Q405 + BHT
d6d234n1	posf2980	NA	227	12	AIR	209	93	55	JP8+8Q405+BHT
d6d272a1	posf2980	16	270	6	AIR	250	785	109	JP8 + 8Q405 + BHT
d6d302a1	posf2980	16	300	6	AIR	266	1660	83	JP8 + 8Q405 + BHT
d6d228a2	posf2980	4	220	24	AIR	193	309	706	JP8 + BHT + 8Q405
d6d230a1	posf2980	4	230	0.5	AIR	195	181	87	JP8 + BHT + 8Q405
d6d231a1	posf2980	4	230	3	AIR	203	257	147	JP8 + BHT + 8Q405
d6d231a2	posf2980	4	230	1.5	AIR	203	216	141	JP8 + BHT + 8Q405
d6d232a1	posf2980	4	230	6	AIR	200	286	134	JP8 + BHT + 8Q405
d6d232a2	posf2980	4	230	6	AIR	200	288	278	JP8 + BHT + 8Q405
d6d234a2	posf2980	4	230	12	AIR	200	296	31	JP8 + BHT + 8Q405
d6d238a1	posf2980	4	230	24	AIR	203	388	1135	JP8 + BHT + 8Q405
d6d302a2	posf2980	16	300	6	AIR	273	1075	202	JP8 FOR 3 HRS. & JP8 + BHT + 8Q405 FOR 3 HRS.
d6d302a3	posf2980	16	300	6	AIR	275	1347	156	JP8 FOR 3 HRS. & JP8 + BHT + 8Q405 FOR 3 HRS.
d6p234a1	posf2980	4	227	12	AIR	200	1148	147	JP8
d6d272a1	posf2980	16	270	6	AIR	245	2239	202	JP8
d6d302a1	posf2980	16	300	6	AIR	276	2145	115	JP8
d6d302a2	posf2980	16	300	6	AIR	269	2351	169	JP8
d6p220a1	posf2980	4	220	0.5	AIR	190	311	143	JP8
d6p221a1	posf2980	4	220	1.5	AIR	194	156	118	JP8
d6p221a2	posf2980	4	220	3	AIR	196	520	172	JP8
d6p222a1	posf2980	4	220	6	AIR	197	491	213	JP8
d6p224a1	posf2980	4	220	12	AIR	190	670	217	JP8
d6p224a2	posf2980	4	220	12	AIR	193	849	227	JP8
d6p224a3	posf2980	4	220	12	AIR	193	887	288	JP8
d6p228a1	posf2980	4	220	24	AIR	189	2166	557	JP8
d6p234a3	posf2980	4	227	12	AIR	197	835	177	JP8
d6p278a1	posf2980	62	270	24	AIR	205	3640	871	JP8
d6p278a2	posf2980	62	270	24	AIR	204	3577	4744	JP8
d6p278a3	posf2980	62	270	24	AIR	206	1802	3837	JP8
d6p278p1	posf2980	62	270	24	8%	209	4972	2976	JP8
d6p278p2	posf2980	62	270	24	1.50%	205	6925	1253	JP8
d6p278p3	posf2980	62	270	24	0%	206	351	183	JP8

Table 4. Phoenix Rig Deposition Tests

Test Name	Fuel	Flow Rate (ml/min)	Block Temp. C	Test Duration (hrs)	Purge Gas Mixture % Oxygen of Total Volume	Bulk Out Temp. C	Heated Section Total Carbon (micrograms)	Cooled Section Total Carbon (micrograms)	Additives*
d6p278p4	posf2980	62	270	24	8%	202	6128	243	JP8
d6p278p5	posf2980	62	270	24	0.50%	203	5608	1395	JP8
d6p295a1	posf2980	100	290	15	AIR	181	2647	2018	JP8
d6p295p1	posf2980	100	290	15	8%	184	5389	871	JP8
d6p295p2	posf2980	100	290	15	1.50%	181	4543	542	JP8
d7b272a1	posf3119	16	270	6	AIR	NA	764	1840	JP8+100 (8Q405+BHT+MDA)
d7b278a1	posf3119	16	270	24	AIR	252	12898	5194	JP8+BHT+8Q405+MDA
d7b302a1	posf3119	16	300	6	AIR	282	1200	954	JP8+100 (8Q405+BHT+MDA)
d7d278a1	posf3119	62	270	24	AIR	219	1091	946	JP8+BHT+8Q405
d7d278a2	posf3119	16	270	24	AIR	255	16330	5860	JP8+BHT+8Q405
d7d278p1	posf3119	62	270	24	AIR	219	940	646	JP8+BHT+8Q405
d7h272a1	posf3119	16	270	6	AIR	256	2729	1550	JP8+BHT
d7h272a2	posf3119	16	270	6	AIR	260	2560	2691	JP8+BHT
d7h278a1	posf3119	62	270	24	AIR	219	30422	5044	JP8+BHT
d7h278a2	posf3119	16	270	24	AIR	255	25427	9631	JP8+BHT
d7h278p1	posf3119	62	270	24	8%	223	31871	616	JP8+BHT
d7h302a1	posf3119	16	300	6	AIR	280	5629	2072	JP8+BHT
d7k272a1	posf3119	16	270	6	AIR	256	528	1661	JP8+BHT+MDA
d7k278a1	posf3119	62	270	24	AIR	220	688	391	JP8+BHT+MDA
d7k278a2	posf3119	16	270	24	AIR	260	9694	6973	JP8+BHT+MDA
d7k278p1	posf3119	62	270	24	8%	NA	912	135	JP8+BHT+MDA
d7k302a1	posf3119	16	300	6	AIR	280	1006	365	JP8+BHT
d7g282p1	posf3119	16	285	6	8%	254	1085	148	Triphenylphosphine (C6H5)3P -.282grams/gal - 209mg/L
d7g302a1	posf3119	16	300	6	AIR	282	4375	1044	Triphenylphosphine (C6H5)3P -.282grams/gal - 209mg/L
d7g302a2	posf3119	16	300	6	AIR	280	3417	724	Triphenylphosphine (C6H5)3P -.282grams/gal - .209g/L
d3n2716a	posf2827	32	270	48	AIR	NA	20400	63970	NONE
d3n272a4	posf2827	16	270	6	AIR	245	659	2299	NONE

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Table 5. Phoenix Rig Oxygen Consumption Tests
(* Test with two heater blocks)

Test Name	O3rval														
Fuel	POSF 2827 JET A + Betz 8Q405 @ 100 mg/liter														
Flow Rate-- (ml/min)	16														
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)														
T Bulk Out (deg C)	181	191	196	199	204	209	214	219	224	227	232	236	241	246	275
% Oxygen Consumed	0.994	0.975	0.962	0.944	0.913	0.895	0.837	0.757	0.662	0.586	0.437	0.281	0.106	0.053	0.054

Test Name	O1nva4														
Fuel	posf2747														
Flow Rate-- (ml/min)	16														
Purge Gas Mixture	21% Oxygen														
T Bulk Out (deg C)	25	163	172	182	187	193	197	202	205	210	218	223	226	235	265
% Oxygen Consumed	0.307	0.308	0.307	0.303	0.302	0.298	0.291	0.282	0.270	0.236	0.110	0.027	0.002	0.000	0.000

Test Name	O3nva9							
Fuel	posf2827							
Flow Rate-- (ml/min)	16							
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)							
T Bulk Out (deg C)	193	203	212	220	230	237	247	265
% Oxygen Consumed	0.955	0.872	0.804	0.694	0.438	0.053	0.053	0.053

Test Name	O3cval							
Fuel	posf2827 BETZ 8Q405 @ 100 mg/liter BHT @ 25 mg/L MOBIL MCP477 @300 mg/L							
Flow Rate-- (ml/min)	16							
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)							
T Bulk Out (deg C)	185	198	204	215	225	235	243	270
% Oxygen Consumed	0.990	0.914	0.796	0.524	0.175	0.060	0.057	0.058

Test Name	O5pval								
Fuel	POSF 2827 JET A + JP8 ADDITIVES								
Flow Rate-- (ml/min)	16								
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)								
T Bulk Out (deg C)	180	186	196	204	214	224	234	243	273
% Oxygen Consumed	0.960	0.938	0.900	0.813	0.672	0.416	0.115	0.055	0.058

Table 5. Phoenix Rig Oxygen Consumption Tests
(* Test with two heater blocks)

Test Name	O3rva1														
Fuel	POSF 2827 JET A + Betz 8Q405 @ 100 mg/liter														
Flow Rate-- (ml/min)	16														
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)														
T Bulk Out (deg C)	181	191	196	199	204	209	214	219	224	227	232	236	241	246	275
% Oxygen Consumed	0.994	0.975	0.962	0.944	0.913	0.895	0.837	0.757	0.662	0.586	0.437	0.281	0.106	0.053	0.054

Test Name	O5sva1							
Fuel	POSF 2827 JET A + JP8 + Betz 8Q405 @ 100 mg/liter							
Flow Rate-- (ml/min)	16							
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)							
T Bulk Out (deg C)	191	199	209	219	227	236	246	275
% Oxygen Consumed	0.917	0.895	0.865	0.757	0.572	0.352	0.054	0.058

Test Name	O4nva1															
Fuel	POSF-2926, TANK S-6															
Flow Rate-- (ml/min)	16															
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)															
T Bulk Out (deg C)	14	173	182	191	200	205	210	214	218	222	227	232	237	246	256	273
% Oxygen Consumed	0.314	0.314	0.311	0.307	0.292	0.280	0.268	0.240	0.173	0.085	0.027	0.025	0.025	0.026	0.025	0.026

Test Name	O4fva1				
Fuel	POSF 2926 JET A + BETZ 8Q405 + BHT				
Flow Rate-- (ml/min)	16				
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)				
T Bulk Out (deg C)	25	212	221	241	266
% Oxygen Consumed	1	0.743	0.122	0.05	0

Test Name	O4pva1						
Fuel	POSF2926 & JP8 Additives						
Flow Rate-- (ml/min)	16						
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)						
T Bulk Out (deg C)	22	180	190	200	210	220	230
% Oxygen Consumed	1	0.973	0.911	0.818	0.554	0.071	0.054

Table 5. Phoenix Rig Oxygen Consumption Tests
(* Test with two heater blocks)

Test Name	O4rval															
Fuel	POSF 2926 & BETZ 8Q405 @ 100mg/L															
Flow Rate-- (ml/min)	16															
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)															
T Bulk Out (deg C)	22	183	193	203	213	223	233									
% Oxygen Consumed	1	0.990	0.978	0.851	0.671	0.186	0.057									
Test Name	O9nval															
Fuel	POSF2976															
Flow Rate-- (ml/min)	16															
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)															
T Bulk Out (deg C)	24	170	180	188	198	208	212	217								
% Oxygen Consumed	1	0.981	0.970	0.970	0.952	0.797	0.396	0.053								
Test Name	O6dval															
Fuel	POSF 2980 + JP8 + Betz 8Q405 + BHT															
Flow Rate-- (ml/min)	16															
Purge Gas Mixture	AIR															
T Bulk Out (deg C)	23	179	185	189	193	198	202	205	211	215	222	227	230	234	239	244
% Oxygen Consumed	1.000	0.945	0.934	0.931	0.925	0.916	0.905	0.890	0.864	0.845	0.806	0.751	0.629	0.463	0.244	0.053
Test Name	O6pval															
Fuel	POSF 2980 + JP8															
Flow Rate-- (ml/min)	16															
Purge Gas Mixture	AIR															
T Bulk Out (deg C)	183	188	191	196	201	207	211	216	220	225	230					
% Oxygen Consumed	0.903	0.887	0.860	0.837	0.789	0.714	0.658	0.568	0.415	0.228	0.050					
Test Name	O7nval															
Fuel	POSF3119															
Flow Rate-- (ml/min)	16															
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)															
T Bulk Out (deg C)	25	165	168	170	177	182	185	190	195	200	201	204	209	211	218	224
% Oxygen Consumed	1.000	0.998	0.999	0.998	0.999	0.991	0.988	0.984	0.974	0.945	0.922	0.908	0.861	0.752	0.598	0.400

Table 5. Phoenix Rig Oxygen Consumption Tests
(* Test with two heater blocks)

Test Name	O9nva3*														
Fuel	POSF2976														
Flow Rate-- (ml/min)	16														
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)														
T Bulk Out (deg C)	180	190	194	197	202	207	212	217							
% Oxygen Consumed	0.929	0.890	0.864	0.833	0.683	0.430	0.137	0.078							
Test Name	O6nva1*														
Fuel	POSF2980														
Flow Rate-- (ml/min)	4														
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)														
T Bulk Out (deg C)	28	167	180	186	191	195	200	206	211						
% Oxygen Consumed	1.000	0.751	0.615	0.474	0.246	0.058	0.056	0.049	0.050						
Test Name	O6dva3*														
Fuel	POSF 2980 JET A + JP8 + BHT + 8Q405														
Flow Rate-- (ml/min)	4														
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)														
T Bulk Out (deg C)	24	162	170	178	184	189	194	199	206	209	217				
% Oxygen Consumed	1	0.966	0.918	0.854	0.752	0.609	0.379	0.057	0.058	0.058	0.067				
Test Name	O6pva3*														
Fuel	POSF 2980 JET A + JP8														
Flow Rate-- (ml/min)	4														
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)														
T Bulk Out (deg C)	145	149	158	162	171	177	182	187	189	194	200	207			
% Oxygen Consumed	0.965	0.955	0.905	0.850	0.675	0.560	0.372	0.083	0.060	0.054	0.058	0.055			
Test Name	O7hva1*														
Fuel	POSF 3119 JET A + JP8 + BHT														
Flow Rate-- (ml/min)	16														
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)														
T Bulk Out (deg C)	25	200	204	208	213	217	220	227	228	233	238	245	254	268	280
% Oxygen Consumed	1	0.943	0.918	0.905	0.857	0.785	0.636	0.302	0.054	0.053	0.054	0.054	0.054	0.054	0.053

Table 5. Phoenix Rig Oxygen Consumption Tests
(* Test with two heater blocks)

Test Name	O7kva1*									
Fuel	POSF 3119 JET A + JP8 + BHT+MDA									
Flow Rate-- (ml/min)	16									
Purge Gas Mixture	NATURAL DIFFUSION (21% O2)									
T Bulk Out (deg C)	25	205	214	221	230	233	240	244	255	280
% Oxygen Consumed	1	0.959	0.932	0.854	0.477	0.059	0.053	0.053	0.053	0.053

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5. FUEL/MATERIALS COMPATIBILITY DATA

Fuel-materials compatibility tests have been conducted with the proposed JP-8+100 additive packages. The purpose of this testing is to identify fuel system materials which may experience significant adverse interactions as a result of prolonged contact with the JP-8+100 jet fuel. This work is also detailed in a separate technical report (21).

A summary of the test results of the materials subjected to thermal aging in the additive test fuels and in the control JP-8 fuel is presented in Table 6. Each material shown is presented in this table at the temperatures to which it was tested. The overall test result/evaluation of this summary table was taken from each materials individual data sheet. The "W" symbol indicates a material test result which was within the allowable requirements set forth. An "O" symbol indicates a material test result which was outside the allowable requirement. The "OT" symbol indicates that a material was tested to a temperature beyond its limits, i.e., to a temperature higher than the material was designed to (or would be expected to) tolerate. The "E" indicates that the material has been tested, but that the evaluation is incomplete. An "I" indicates that a test still is planned but has not yet been conducted. The "NT" indicates no test is planned. The use of the symbol "CN" indicates control (fuel) and is primarily associated with metallics.

The *metallic* materials evaluation compares results obtained when materials were subjected to the JP-8 test fuels (JP-8 +100 and JP-8 +100 x4) to results obtained when materials were subjected to the JP-8 control fuel. In contrast, the *non-metallics* evaluation measures results obtained when materials were subjected to the control fuel (JP-8) against the same test evaluation criteria (specifications and standards) as results obtained when materials were subjected to test fuels (containing thermal stability additives).

Materials are reported in the following test results sections as having **"passed"** when they are assigned a **"W"** (within allowable requirement) for *all* material property tests in the data collection format.

Materials are reported as having **"failed"** when they were rated with an **"O"** (outside allowable requirement) in *any* material property test in the data collection format. A material that is reported as having failed may actually have had acceptable ("W," within allowable requirement) results in one or more of the tests. A material has failed in the context of this report when it has failed to meet the allowable requirement in *any one* test.

Materials are reported as having **"failed"** when they were rated with an **"OT"** (material tested beyond temperature range) even though the material would not have been expected to tolerate the test temperatures.

The Betz additive package was judged acceptable primarily based on its comparison to JP-8 (control) fuel.

This report contains a selected few of the more than 300 data pages from the database for all the materials' individual physical property test results/evaluations for a given temperature and the thermal aging test period(s) 28/7 days.

Two formats were developed to display the consolidated thermal aging test results and evaluations of each individual material of this program. These formats contain both the material/fuel exposure results and the fuel/material exposure test results. The non-metallics format contains all the material property test results, evaluation criteria and the evaluation of those results, as well as the fuel/material exposure control fuel general observations. The metallic format contains all the material property test results and the evaluation of those results as well as the fuel/material exposure/control fuel and general observations.

The control fuel results are shown in order to illustrate the effects of thermal stress on fuel without the inclusion of a metallic or non-metallic fuel system material. The control fuel was not necessarily thermally stressed (at the same time as the test fuel/material exposure. The <u>two control fuels</u> used were JP-8 (POSF-2980) or, later (June 1995) in the test program, JP-8 (POSF-2926). The fuel designations are recorded in the upper right hand corner of each test material data sheet.

The test fuels were: *a)* JP-8 (POSF-2980) with thermal stability additive at a *normal* concentration (+100); and *b)* JP-8 (POSF-2980) with thermal stability additive at a *four times normal* concentration (+100 x4). During the 1997 calendar year, POSF-2926 was used exclusively as both the test fuel and the baseline fuel due to the depletion of POSF-2980 fuel.

Selected data from more than 225 materials (300 tests) are shown in Table 7: for nitrile O-rings at 160, 180, 200, 250, and 325F, and for CPM 10V metallic material at 325F. The O ring data illustrates the effect of temperature on the material.

Screening test results for the control fuel and several +100 fuel additives are included as Table 8 to illustrate the effect of two different fuels (POSF-2926 and POSF-2980) on three selected materials.

Table 6. Fuel/Material Test Result Summary Table

Test ID	*Material*	*Type*	*Temp*	*JP8*	*JP8 +100*	*JP8 + 100 x4*
I.A.1	Adhesive, Epoxy Polyamide, EC 3569, Bk-127 Lot#25D2P	Epoxy/Polyamide	200	W	W	W
I.A.2	Adhesive, FM 47 Vinyl Phenolic	Vinyl	200	OT	OT	W
I.A.3	Adhesive, AF 126-2, Nitrile, Mod. Epoxy	Nitrile	200	W	W	W
I.A.4	Adhesive, AF 143-2, BR-127, Mod. Hi Temp Epoxy	Epoxy	200	W	W	W
I.A.5	Adhesive, EPON 828/DTA, Un. Mod.Epoxy		200	W	W	W
I.A.6	Adhesive, FM73 W/BR-127 Primer, Nitrile Mod. Epoxy	Nitrile epoxy	200	W	W	W
I.A.7	Adhesive, AF-10E/EC 1290 Primer, Scotchweld	Primer Scotchweld	200	W	W	W
I.A.8	Adhesive, AF-10 W/EC 3950, Primer Scotchweld			NT	NT	NT
I.A.9	Adhesive, EC776 Mil-S-4383, 3M Co., Nitrile	Nitrile	200	O	W	W
I.B.1	Bladder Tank, AM Fuel PS-598, Nitrile		200	OT	W	OT
I.B.10	Goodyear 80C39	Polyurethane		NT	NT	NT
I.B.11	Bladder Tank, Engineered Fabrics 3572N, Nylon Structural Cloth	Nylon	200	W	W	W
I.B.12	Bladder Tank, Engineered Fabrics P/N 491, Nylon Structural Cloth	Polyester	200	W	W	W
I.B.13	Amfuel PN C121	Nylon	200	W	W	W
I.B.14	Amfuel Cloth PN C130		200	W	W	W
I.B.2	Bladder Tank, AMFuel U5200B, Nitrile	Nitrile	200	OT	OT	OT
I.B.3	Bladder Tank, AMFuel PU 339, Polyurethane	Polyurethane	200	W	W	W
I.B.4	Bladder Tank, Engineered Fabrics, PN 51956, Nitrile	Nitrile	160	W	W	W
I.B.5	Bladder Tank, Engineered Fabrics, P/N 5904C, Polyurethane	Polyurethane	160	O	O	O
			200	OT	OT	OT
I.B.6	Goodyear 26950	Nitrile		NT	NT	NT
I.B.7	Bladder Tank, Goodyear 51956, Nitrile		200	OT	OT	OT
I.B.8	Bladder Tank, Goodyear 80C29, Urethane	Urethane	200	OT	OT	OT
I.B.9	Goodyear 80C29	Nitrile		NT	NT	NT
I.C.1	Adhesive, EC776 Mil-S-4383, 3M Co., Nitrile		200	O	W	W
I.C.2	MIL-C-27725, Polyuerethane	Polyurethane	200	W	W	W
I.C.3	BMS 10-20 Epoxy	Epoxy	200	W	W	W
I.C.4	Sealant, PR-1440 B2 Pro Seal BMS 5-267, Maganese, Mil-S-8802F	Mn	200	W	W	W
I.C.5	MMS-425, PR2911		200	W	W	W
I.D.1	Sealant, PR 1422, Type I, B2, Mil-S-8802F, Dichromate	Dichromate	200	W	W	W
I.D.10	Sealant, PR-705, Polysulfide	Polysulfide	200	W	W	W
I.D.11	Sealant, DC9403, Fluorosilicone Mil-S-55334	Fluorosilicone	200	W	W	W

W = Within Tolerance: O = Out of Tolerance: OT = Tested beyond material's Temperature Range: I = Test Planned
E = Evaluation incomplete (tested): NT = No test planned: CN = Control: * Denotes 7 day test data available

Table 6. Fuel/Material Test Result Summary Table

Test ID	*Material*	*Type*	*Temp*	*JP8*	*JP8 +100*	*JP8 + 100 x4*
I.D.12	Sealant, G651, Cyanosilicone	Cyanosilicone		NT	NT	NT
I.D.2	Sealant, PR-1440 B2 Pro Seal BMS 5-267, Maganese, Mil-S-8802F	Mn	200	W	W	W
I.D.3	Sealant, PR-1750 B2, Manganese Mil-S-83430A		200	W	W	W
I.D.4	Sealant, PR1221, B2 Mil-S-7502, Lead Dioxide	Lead dioxide		NT	NT	NT
I.D.5	Sealant, Q4-2817 W1200 Primer, Fluorosilicone	Fluorosilicone	200	W	W	W
I.D.6	Sealant, PR2911, Polyurethane	Polyurethane	200	O	O	O
I.D.7	Sealant, PR-1828 B2 Polythioether	Polythioether	200	W	W	W
I.D.8	Sealant, PR-1776 B2, Polysulfide AMS 3281	Polysulfide	160	W	W	O
			200	OT	OT	OT
I.D.9	Sealant, PR1775 B2, Polysulfide AMS 3265		160	W	W	W
			200	OT	OT	OT
I.E.1	Composite, AS4/3501-6, Epoxy graphite	Epoxy graphite	200	W	W	W
I.E.2	Composite, IM7/5250-4(BMI), Graphite Bismaliemide	Graphite	200	W	W	W
I.E.3	Composite, AS 7/8551-7A Epoxy graphite	Epoxy graphite	200	W	W	W
I.E.4	Composite	Fiberglass		NT	NT	NT
I.E.5		Epoxy Resin		NT	NT	NT
I.F.1	Borosilicate 0.4 + 07.0 Formula (Glass Fibers)	Phenolic, latex, acrylic, epoxy binders	200	I	NT	I
I.F.2	Screen	Unknown	200	I	NT	I
I.F.3	Foam, FOMEX YELLOW TYPE II, Polyester, MIL-B-83054	Polyurethane (ester)	200	W	W	W
I.F.4	Foam, FOMEX BLUE TYPE IV, Polyether, Mil-B-83054	Polyurethane (ether)	200	W	W	W
I.F.5	Foam, FOMEX, GRAY CLASS 1, Polyether, Mil-F-87260		200	W	W	W
I.F.6	Foam, CREST, GREY CLASS II., Polyther Mil-F-87260		200	W	W	W
I.F.7	Foam, Foamex, Charcoal Gray Class II, Polyurethane Mil-F-87260			NT	NT	NT
I.F.8	Foam, Crest, Yellow Type II Non-conductive, Polyurethane Mil-B-80354	Polyurethane (ester)		W	W	W
I.G.1	"O" ring, Nitrile, N-756 (Parker), MIL-P-83461	Nitrile	160	O	O	O
			200	O	O	O
I.G.10	"O" ring, Fluorosilicone, ES2000/8539 (Bendix) Mil-R-25988	Fluorosilicone		NT	NT	NT
I.G.11	Washer, Urethane, PO-652/P/N 212147Argo-TECH	Urethane	160	W	W	W
			200	OT	OT	OT
I.G.12	Tank, Urethane, P/N 212351 ArgoTECH JT90		200	W	W	W

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Table 6. Fuel/Material Test Result Summary Table

Test ID	*Material*	*Type*	*Temp*	*JP8*	*JP8 +100*	*JP8 + 100 x4*
I.G.13	Cork, P/N 30-155-5-1 Parker	Cork	200	W	W	W
I.G.14	"O" Rin, Nitrile, Mil-P-83461 (hydraulic)	Nitrile	200	O	O	O
I.G.2	"O" ring, Nitrile, N304-75 (Parker), Mil-P-25732		160	O	O	O
			200	O*	O*	O*
I.G.3	"O" ring, Nitrile N-602-70 (Parker), Mil-P-5315		160	O	W	W
			180	OT	OT	OT
			200	OT	OT	OT
			200	OT	OT	OT
			325	OT	OT	OT
I.G.4	"O" ring, Nitrile, N 506-65 (Parker) AMS 7271/MS 9201		160	W	W	W
			200	OT	OT	OT
I.G.5	"O" ring, Fluorosilicone (Parker) L 677-70, Mil-P-25988	Fluorosilicone	200	W*	W*	W*
I.G.6	"O" ring, Fluorocarbon (Parker) V 747-75 (Viton) Mil-R-83248	Fluoroelastomer	200	W*	W*	W*
I.G.7	"O" ring, Fluorocarbon (Parker) V0835-75 (Viton) GLT Mil-R-83485		200	W	W	W
I.G.8	"O" ring, Perfluoroelastomer, 93244G Kalrez DuPont, AMS7257A	Kalrez	200	W	W	W
I.G.9	"O" ring, Nitrile, CLS8715#74-2 Coast Craft, ASE3	Nitrile	160	O	O	O
			200	OT	OT	OT
I.H.1	Self Sealing Hose			NT	NT	NT
I.H.2	ACRYLIC/NITRATE/DURODYNE P/N AC603-01 Mil-H-4495	Acrylic/nitrile	160	W	NT	NT
			200	OT	OT	OT
I.H.3	NITRATE/DURODYNE P/N AC646-01 Mil-H-370	Nitrile	200	OT	OT	OT
I.H.4	NITRATE/DURODYNE P/N AC6611-06 Mil-H-17902		200	OT	OT	OT
I.H.5	EPICHLOROHYDRIN/DURODYNE P/N EC61401 Mil-H-26521	Epichlorohydrin	200	OT	W	W
I.I.1	TFE (TEFLON)	Teflon	200	O	O	O
I.I.10	Teflon/Kapton	Hybrid Teflon	200	I	I	I
I.I.11	Shrink Wrap		200	I	I	I
I.I.2	Nylon 66 /DuPont Zytel 101, ASTM D 4066 - Old	Nylon	160	O	O	O
			200	O	O	O
I.I.3	Polyethylene (HDP)	Polyethylene	200	O	O	O
I.I.4	KAPTON/UPILEX	Kapton	200	W	W	W
I.I.5	Marmon			NT	NT	NT

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Table 6. Fuel/Material Test Result Summary Table

Test ID	*Material*	*Type*	*Temp*	*JP8*	*JP8 +100*	*JP8 + 100 x4*
I.I.6	Vinyl Plastic tubing Mil-I-7444 Type I	Vinyl Plastic	200	E	E	E
I.I.7	Kynar	Shrink Wrap	200	W	W	W
I.I.9	Magnetic Wire Insulation type I	HML Varnish	325	I	I	I
I.J.1	2219 T87 Aluminum, welded UNS A92319/4191D (AMS)	Al	200	CN	W	W
I.J.10	321 SS, Brazed	SS	325	CN	W	W
I.J.11	Tin & Lead, QQ-S-571, SN60(Tin 60%, Lead 40%) B-36-21A	Pb, Sn	200	CN	W	W
			325	OT	OT	OT
I.J.12	6061 T-6 Mil-B-7883 Type V Grade B, Dip Braze		200	CN	W	W
I.J.13	Ti, Cu, Ni Braze, P&W	Ti, Cu, Ni	325	CN	W	W
I.J.14	Aluminum, 6061-T6, Welded With 4043 Filler	Al	200	CN	W	W
			325	CN	W	W
I.J.15	5052 H-34 Welded w/ 6061T6 w/ 5356 Filler		200	I	I	I
I.J.16	SN 95, Sb05 Base Material, B36-21A	Cu	200	I	I	I
I.J.2	Match Fill 6AL-AV(Ti), Welded	Matchfill	325	CN	W	W
I.J.3	Match Fill, 3AL-2.5V(Ti), Welded		325	CN	W	W
I.J.4	Match Fill, Inco 718 Nickel (Welded)		200	CN	W	W
			325	CN	W	W
I.J.5	Match Fill, Inco 625 (Ni), Welded		325	CN	W	W
I.J.6	Match Fill, 321, SS Ferrous (Welded)		200	CN	W	W
			325	CN	W	W
I.J.7	Match Fill, IN200/201 Nickel, Welded		325	CN	W	W
I.J.8	In200/In201, Welded	BNI	325	CN	W	W
I.J.9	Waspalloy (Ni), Brazed AMS 4786 AG	AMS 4786 Ag	325	CN	W	W
I.K.1.1	Cover, Ink Stamp, Coating QQ-A-25011, EC 776		200	W	W	W
I.K.1.2	Cover, Ink Stamp, Coatings QQ-A-25011, EC 776		200	W	W	W
I.K.1.3			200	W	W	W
I.K.10.1	BF Boodrich Probe P/N 391002-250	Coating	200	I	I	I
I.K.10.2	BF Boodrich Electronics P/N 391002-250		200	I	I	I
I.K.11.1	Ragan Data Systems, Probe P/N 75-108-2F		200	I	I	I
I.K.11.2	Ragan Data Systems, Electronics P/N 75-108-2F		200	I	I	I
I.K.12	Ametek Aerospace Products CH-5851-L	Polysulfide	200	I	I	I
I.K.2	Dry Film Lubricant, Dicronite DoD-L-85645	dicronite	200	I	I	I
I.K.3	Dry thread lubricant	Graphite	200	I	I	I
I.K.4	Name plate, QQA-250/1, Color A11136		200	W	W	W
I.K.5	Dry Film Lubricant	Mo disulfide	200	I	I	I
I.K.6a		Al varnish		NT	NT	NT

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Test ID	*Material*	*Type*	*Temp*	*JP8*	*JP8 +100*	*JP8 + 100 x4*
I.K.6b	Resin No48-C-31, ES#11110 Midland Div			NT	NT	NT
I.K.6c	Reducer: LAMNERX500 Spec. No. 66-C-28, ES#11110 Midland Div			NT	NT	NT
I.K.7	Carbon Bearing #6001, Cr Plate	SS	200	W	W	W
I.K.8.1	Pump Pure Carbon co. PG18RCH		325	I	I	I
I.K.8.2	Pump P658RCH Pure Carbon co.		325	W	W	W
I.K.8.3	Pump Pure Carbon co. P5N2		325	W	W	W
I.K.9	Seal, Mil-L-46010B, Type I, Micro-seal Green tweed		200	I	I	I
I.L.1	Threadlock MIL-5-22473 GRADE A or AV, Loctite		200	W	W	W
I.L.2	Threadlock MIL-S-22473 (Red), Loctite 272		200	W	W	W
I.L.3	Threadlock MIL-S-22473 (Brown) Loctite 222		200	W	W	W
I.M.1	5052-0 Bare Aluminum	Al	200	CN	W	W
			325	CN	W	W
I.M.10	A 355-T6 Cast Aluminum		200	CN	W	W
I.M.11	A 356-T6 Cast Aluminum		200	CN	W	W
I.M.12	7050-T74 Bare Aluminum		200	CN	W	W
I.M.13	316 Stainless Steel (Passivated), Ferrous	SS	200	CN	W	W
I.M.14	321 Stainless Steel (Passivated), Ferrous		200	CN	W	W
I.M.15	304 Stainless Steel (Passivated) Ferrous		200	CN	W	W
I.M.16	718 INCO, Nickel	Ni	200	CN	W	W
I.M.17	440C Stainless Steel, AMS 5630, Fe	SS	200	CN	W	W
I.M.18	347 Stainless Steel, Fe		200	CN	W	W
I.M.19	Alloy 30302 AMS 5688H, Fe		200	CN	W	W
I.M.2	6061-T4 Bare Aluminum	Al	200	CN	W	W
			325	OT	OT	OT
I.M.20	17-4 Ph AMS 5604/5643 Stainless Steel, Fe	SS	200	CN	W	W
I.M.21	1010 Cadmium Plate (Class 2), Ferrous	Ferrous	325	CN	W	W
I.M.22	1010 Zinc Plate, Ferrous		325	CN	W	W
I.M.23	4130 Cadmium (Class 2) Plate Steel		200	CN	W	W
I.M.24	6AL-4V, Titanium	Ti	200	CN	W	W
I.M.25	950 Bronze Aluminum, Cu	Cu/Al	200	CN	W	W
			325	CN	W	W
I.M.26a	Naval Brass (Cu/Ni - 70/30)	Cu/Ni	200	CN	W	W
I.M.26b	Naval Brass (Cu/Ni - 90/10)		200	CN	W	W
I.M.27	Brass, Sheet 268, Substitute 260, Copper	Cu	160	CN	W	W
			200	CN	W	W
			325	CN	W	W
I.M.28	Lead, AMS 4751/4750	Pb	200	CN	W	W
			325	CN	W	W

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Table 6. Fuel/Material Test Result Summary Table

Test ID	*Material*	*Type*	*Temp*	*JP8*	*JP8 +100*	*JP8 + 100 x4*
I.M.29	Shaw Aerospace - Barium Ferrite	Ba	160	CN	W	W
			200	OT	OT	OT
			325	OT	OT	OT
I.M.3	6061-T6 Bare Aluminum	Al	200	CN	W	W
			325	CN	W	W
I.M.30	NEO-DYMIUM, ND		160	E	E	E
			200	CN	W	W
			325	CN	W	W
I.M.31	Copper Brass Sheet, ASTM B36-21A	Cu	200	CN	W	W
			325	CN	W	W
I.M.32	1010 Bare, Fe	Ferrous	200	CN	W	W
			325	CN	W	W
I.M.33	ASTM B-29, Soft Lead	Pb	200	CN	W	W
I.M.34	Monel 400 Sheet, Ni/Cu	Cu/Ni	325	CN	W	W
I.M.35	15-5PH, Stainless Steel, Fe, Cr, Ni, Cu,	Ferrous	325	CN	W	W
I.M.36	5052 - H34 Aluminum	Al	200	CN	W	W
I.M.37	1045 Cadmium Plate Class II, Type 2 Gold, Fe	Ferrous	325	CN	W	W
I.M.38	1045 Bare Fe		325	CN	W	W
I.M.39	AZ91 T-6 (Substitute AZ31 - N24), Mg	Mg	200	CN	W	W
I.M.4	7075-T6 Aluminum, Chromic Acid Anodized	Al	200	CN	W	W
			325	OT	OT	OT
I.M.40	4130 Bare, Steel, Fe	Ferrous	325	CN	W	W
I.M.41	Sn 95, Sb 05	solder	200	CN	W	W
I.M.42	2014T6 AMS 4029	Al	200	I	I	I
I.M.43	4340, AMS6415 280KSI Tensile	Steel	325	I	I	I
I.M.5	7075-T6 ALODINE/200 Aluminum	Al	200	CN	W	W
			325	OT	OT	OT
I.M.6	7075-T6 Bare Aluminum		200	CN	W	W
			325	OT	OT	OT
I.M.7	2024-T3 Bare Aluminum		200	CN	W	W
			325	CN	W	W
I.M.8	2219-T87 Bare Aluminum		200	CN	W	W
			325	OT	OT	OT
I.M.9	3003 Bare Aluminum		200	CN	W	W
			325	CN	W	W
I.O.1	Unicellular Buna-n HR Textron	Buna N	225	W	W	W
I.O.2	Unicellular Buna-n HR Textron, Foam Moulding Inc	Polyurethane	225	W	W	W
I.O.3	Polyurethane, HR Textron, Custom Foam, Sample 1		225	W	W	W
I.O.4	Polyurethane, HR Textron, Custom Foam, Sample 2		225	W	W	W

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Table 6. Fuel/Material Test Result Summary Table

Test ID	*Material*	*Type*	*Temp*	*JP8*	*JP8 +100*	*JP8 + 100 x4*
I.O.5	Polyurethane, HR Textron, Custom Foam, Sample 3	Polyurethane	225	W	W	W
I.O.6	Polyurethane, HR Textron, Custom Foam, Sample 4		225	W	W	W
I.O.7	Floats, XAR Industries Inc.		225	W	W	W
I.O.8	Cork, Parker 30-155-5-1	Cork	200	W	W	W
I.P.1	Epoxy, Epon 828 DETA	Epoxy	200	W	W	W
I.P.2.1	Polysulfide/(film) Chem seal CS3100 Mil-S-8516	Polysulfide	200	O	O	O
I.P.2.2	CS3100 Chem Seal Mil-S-8516		200	E	E	E
I.P.3	Fluorosilicone, AMS 3361	Fluorosilicone	200	nl	NT	NT
I.P.4	Urethane	Urethane	200	NT	NT	NT
II.G.1	"O" ring, Fluorosilicone, ES2000/8539 (Bendix) Mil-R-25988	Fluorosilicone	275	OT	OT	OT
			325	OT	OT	OT
II.G.10	Washer, Urethane, PO-652/P/N 212147Argo-TECH	Urethane	160	W	W	W
			200	OT	OT	OT
			325	OT	OT	OT
II.G.11	Tank, Urethane, P/N 212351 ArgoTech JT90		200	W	W	W
			325	OT	OT	OT
II.G.12	"O" ring, Fluorocarbon, GTC 778, Green Tweed Mil-R-83485	Fluorocarbon	325	W	W	W
			400	W	W	W
II.G.13	"O" ring, Fluorosilicone, GTC B-95, Green Tweed Mil-R-25988	Fluorosilicone	200	W	W	O
			325	OT	OT	OT
II.G.14	"O" ring, Fluorosilicone, Stillman TH-1384 Mil-R-25988		180	W	W	W
II.G.15	"O" ring, Fluorosilicone L-1186-80, Parker Mil-R-25988		200	W	W	W
II.G.2	"O" ring, Fluorosilicone (Parker) L 677-70, Mil-P-25988		200	W	W	W
			250	OT	W	W
			325	OT	OT	OT
II.G.3	"O" ring, Fluorocarbon (Parker) V0835-75 (Viton) GLT Mil-R-83485	Fluoroelastomer	200	W	W	W
			325	W	W	W
			400	W	W	W
II.G.4	"O" ring, Perfluoroelastomer, 93244G Kalrez DuPont, AMS7257A	perfluoroelastomer	200	W	W	W
			325	W	W	W

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Table 6. Fuel/Material Test Result Summary Table

Test ID	*Material*	*Type*	*Temp*	*JP8*	*JP8 +100*	*JP8 + 100 x4*
II.G.5	"O" ring, Fluorosilicone, ESS928 JONAL (Bendix) Mil-R-25988(MOD)	Fluorosilicone	275	OT	OT	OT
			325	OT	OT	OT
II.G.6	"O" ring, Fluorocarbonr, GTC 777, Green Tweed Mil-R-83485	Fluoroelastomer	325	W	W	W
			400	W	W	W
II.G.7	"O" ring, Fluorosilicone, GTC 409, Green Tweed, Mil-R-25988	Fluorosilicone	325	OT*	OT*	OT*
II.G.8	"O" ring, Perfluoroelastomer, GTC 505, Green Tweed, AMS7257A	Perfluoroelastomer	325	O	O	O
II.G.9	"O" ring, Fluorocarbon (Parker) V 747-75 (Viton) Mil-R-83248	Fluoroelastomer	200	W*	W*	W*
			325	O	O	O
II.M.1	6AL-4V, Titanium	Ti	325	CN	W	W
II.M.10	Alloy 30302 AMS 5688H, Fe	SS	325	CN	W	W
II.M.11	440C Stainless Steel, AMS 5630, Fe		325	CN	W	W
II.M.12	304 Stainless Steel (Passivated) Ferrous		325	CN	W	W
II.M.13	316 Stainless Steel (Passivated), Ferrous		325	CN	W	W
II.M.14	321 Stainless Steel (Passivated), Ferrous		325	CN	W	W
II.M.16	ASI 51410SS (AMS 5504-J)		200	E	E	E
			325	CN	W	W
II.M.17	440C Stainless Steel, AMS 5630, Fe	Steel	325	CN	W	W
II.M.18	Powder Metallurgy cpm 10V (Rolled Fe, V, CR, C, Mn, SiI, T,S,Mo CPM 10V)		325	CN	W	W
II.M.19	A 355-T6 Cast Aluminum	Al	325	CN	W	W
II.M.2	3Al-2.5V, Titanium	Ti	200	CN	W	W
			325	CN	W	W
			400	CN	W	W
II.M.20	C 356-T6 Cast Aluminum	Al	325	CN	W	W
II.M.21	A-286 AMS 5525, 2410 Silver Plate	Ferrous	200	CN	W	W
			325	CN	W	W
II.M.22	135 Modified AMS 6470J, Nitalloy, MIL-S-6709	Nitalloy	200	CN	W	W
			325	CN	W	W
II.M.23.1	Leaded bronze (Tap MS 285), Saw cut, Cu (New Type)	Cu	160	CN	W	W
			200	CN	W	W
			325	CN	W	W
II.M.23.2	Leaded bronze (Tap MS 285), (Polished Cylinder End Drylube)		160	CN	W	W
			200	CN	W	W
			325	CN	W	W

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Test ID	*Material*	*Type*	*Temp*	*JP8*	*JP8 +100*	*JP8 + 100 x4*
II.M.23.3	Leaded bronze (Tap MS 285), Coated Cylinder (Indium), Argo-Tech		325	CN	W	W
II.M.23.4	Leaded bronze (Tap MS 285), Coated Cylinder (Indium), ArgoTech "B"		325	CN	W	W
			400	CN	W	W
II.M.24	17-4 Ph AMS 5604/5643 Stainless Steel, Fe	Ferrous	325	CN	W	W
II.M.25	IN 200, Nickel	Ni	200	CN	W	W
			325	CN	W	W
II.M.26	Augmentor spray bar, SS, Brazed Nozzles (P&W)	SS	325	CN	W	W
II.M.27	Monel 400 Sheet, Ni/Cu	Cu/Ni	325	CN	W	W
II.M.28	Incolloy 909, Ni, Co, Fe	Ni, Co, Fe	325	CN	W	W
II.M.29	Titanium 6-2-4-2 sheet, AMS 4919C	Ti, Al, Sn	325	CN	W	W
II.M.3	Hastalloy, Nickel Alloy, 5536K	Ni	200	CN	W	W
			325	CN	W	W
II.M.30	HAYNES 188 (Co, Cr, Ni)	Co, Cr, Ni	325	CN	W	W
II.M.31	HAYNES 214 (Fe, Al, Cr, Ni)	Co, Cr, fe	325	NT	NT	NT
II.M.32.1	AMS 7902 Beryllium Alloy, Al, Be, Met 162 (as cast alloy 310)		325	CN	W	W
II.M.32.2	AMS 7902 Beryllium Alloy, Al, Be, Met 162 (Mach. Surfaces 157)		325	CN	W	W
II.M.32.3	AMS 7902 Beryllium Alloy, Al, Be, Met 162 (AM 162 rolled std. grind finish))		325	CN	W	W
II.M.33	UNS C17200 Be Cu Spring	Cu, Be	325	CN	W	W
II.M.34	DB Inconel 718 Fusion Bond, Ni/Cr	Cr, Ni	325	CN	W	W
			400	NT	NT	NT
II.M.35	17-4 PH H-1000, SS	SS	325	CN	W	W
II.M.36	8 Al-1V-21 Mo,Ti	Ti	325	CN	W	W
II.M.37	Ion Vapor Deposit IVD on 4130	Steel	325	I	I	I
II.M.38	52100 AMS644H		325	I	I	I
II.M.39	8620 AMS6277E		325	I	I	I
II.M.4	WASPALLOY, Nickel, AMS 5544E	Ni	200	CN	W	W
			325	CN	W	W
II.M.5	INCO 625, Nickel Alloy, AMS 55990		200	CN	W	W
			325	CN	W	W
II.M.6	718 INCO, Nickel, AMS 5596G		200	CN	W	W
			325	CN	W	W
II.M.7	STELLITE 30, Cu, Cr	Cr, Cu	325	CN	W	W
II.M.8	347 Stainless Steel, Fe	SS	325	CN	W	W
II.M.9	Greek Ascolloy, Ferrous, AMS 5616	Ferrous	200	CN	W	W
			325	CN	W	W

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Table 7. Selected Fuel/Material Data

Wright Patterson Air Force Base
and the
University of Dayton

Material Test Data Non-Metals

Material ID	I.G.3	**Material:**	"O" ring, Nitrile N-602-70 (Parker), Mil-P-5315
Temperature (F):	160	**Use:**	Airframe, Fuel systems gaskets, "O"-Ring
Test date:	15-Feb-96	**Additive/Fuel:**	Betz Dearborn 8Q462 (Normal & x4 Concentrations)/93-POSF-2980
Test Length (days):	28	**Baseline Fuel:**	92-POSF-2926 + (JP8 Additives)

Material Property Tests	post JP8	post JP8+100	post JP8 +100 x 4	Control Material	Evaluations JP8	JP8+100	JP8+100 x 4
Compression Set	9	12	6	NA	W	W	W
Elongation (%)	199	199	202	264	W	W	W
Hardness, Shore A (pts)	57	65	65	66	W	W	W
Tensile (PSI)	1009	1526	1592	1712	O	W	W
Volume Swell (%)	16	17	17	NA	W	W	W

Fuel Property Test	JP8 w/material	JP8 + 100 w/material	JP8+100 x4 w/material
Acid No. (mg KOH/gm)	NE	.004	.004
Conductivity (pS/m) @72F	15	400	662
Gums (mg/100ml)	NE	4.4	41.4
Hydroperoxides (mM)	NE	0	0

Evaluation Criteria

Compression Set	Maximum Value	50%
Elongation (%)	Decrease	25%
Hardness, Shore A (pts)	Decrease/Increase	5pts/5pts
Tensile (PSI)	Decrease	25%
Volume Swell (%)	Min/Max	0%/25%

Color - C ,C1--C6 is Clear, light to dark
W = Within Tolerance; O = Out of Tolerance;
NSR = No Specification; NE Not Evaluated; NA = Not Applicable; ND = Not Detected

Table 7. Selected Fuel/Material Data

Material Test Data Non-Metals

Wright Patterson Air Force Base
and the
University of Dayton

Material ID	I.G.3	**Material:**	"O" ring, Nitrile N-602-70 (Parker), Mil-P-5315
Temperature (F):	180	**Use:**	Airframe, Fuel systems gaskets, "O"-Ring
Test date:	14-Mar-96	**Additive/Fuel:**	Betz Dearborn 8Q462 (Normal & x4 Concentrations)/93-POSF-2980
Test Length (days):	28	**Baseline Fuel:**	92-POSF-2926 + (JP8 Additives)

Material Property Tests	post JP8	post JP8+100	post JP8 +100 x 4	Control Material	Evaluations JP8	Evaluations JP8+100	Evaluations JP8+100 x 4
Compression Set	19	24	25	NA	W	W	W
Elongation (%)	232	223	187	264	W	W	O
Hardness, Shore A (pts)	55	57	62	66	OT	OT	W
Tensile (PSI)	1163	1093	1320	1712	OT	OT	W
Volume Swell (%)	18	17	17	NA	W	W	W

Fuel Property Test	JP8 w/material	JP8 + 100 w/material	JP8+100 x4 w/material
Acid No. (mg KOH/gm)	0.006	0.003	0.004
Color	C1	C1	C1
Conductivity (pS/m) @72F	149	376	604
Gums (mg/100ml)	3.2	5.4	12.4
Hydroperoxides (mM)	0.37	0	0

Evaluation Criteria

Compression Set	Maximum Value	50%
Elongation (%)	Decrease	25%
Hardness, Shore A (pts)	Decrease/Increase	5pts/5pts
Tensile (PSI)	Decrease	25%
Volume Swell (%)	Min/Max	0%/25%

Color - C ,C1--C6 is Clear, light to dark
W = Within Tolerance; O = Out of Tolerance;
NSR = No Specification; NE Not Evaluated; NA = Not Applicable; ND = Not Detected

Table 7. Selected Fuel/Material Data

Material Test Data Non-Metals

Wright Patterson Air Force Base
and the
University of Dayton

Material ID	I.G.3	**Material:**	"O" ring, Nitrile N-602-70 (Parker), Mil-P-5315
Temperature (F):	200	**Use:**	Airframe, Fuel systems gaskets, "O"-Ring
Test date:	21-Nov-94	**Additive/Fuel:**	Betz Dearborn 8Q462 (Normal & x4 Concentrations)/93-POSF-2980
Test Length (days):	28	**Baseline Fuel:**	93-POSF-2980 + (JP8 Additives)

Material Property Tests	post JP8	post JP8+100	post JP8 +100 x 4	Control Material	Evaluations JP8	JP8+100	JP8+100 x 4
Compression Set	37	41	40	NA	W	W	W
Elongation (%)	34	138	147	265	OT	OT	OT
Hardness, Shore A (pts)	76	63	63	69	OT	OT	OT
Tensile (PSI)	174	991	1211	1970	OT	OT	OT
Volume Swell (%)	16	17	18	NA	W	W	W

Fuel Property Test	JP8 w/material	JP8 + 100 w/material	JP8+100 x4 w/material

Evaluation Criteria

Compression Set	Maximum Value	50%
Elongation (%)	Decrease	25%
Hardness, Shore A (pts)	Decrease/Increase	5pts/5pts
Tensile (PSI)	Decrease	25%
Volume Swell (%)	Min/Max	0%/25%

Color - C ,C1--C6 is Clear, light to dark
W = Within Tolerance; O = Out of Tolerance;
NSR = No Specification; NE Not Evaluated; NA = Not Applicable; ND = Not Detected

Table 7. Selected Fuel/Material Data

Material Test Data Non-Metals

Wright Patterson Air Force Base
and the
University of Dayton

Material ID	I.G.3	**Material:**	"O" ring, Nitrile N-602-70 (Parker), Mil-P-5315
Temperature (F):	325	**Use:**	Airframe, Fuel systems gaskets, "O"-Ring
Test date:	16-Nov-95	**Additive/Fuel:**	Betz Dearborn 8Q462 (Normal & x4 Concentrations)/93-POSF-2980
Test Length (days):	28	**Baseline Fuel:**	93-POSF-2980 + (JP8 Additives)

Material Property Tests	post JP8	post JP8+100	post JP8 +100 x 4	Control Material	Evaluations JP8	JP8+100	JP8+100 x 4
Compression Set	170	162	147	NA	OT	OT	OT
Elongation (%)	35	Broke	23	265	OT	OT	OT
Hardness, Shore A (pts)	70	82	75	69	W	OT	W
Tensile (PSI)	132	Broke	111	1970	OT	OT	OT
Volume Swell (%)	19	15	15	N/A	W	W	W

Fuel Property Test	JP8 w/material	JP8 + 100 w/material	JP8+100 x4 w/material
Acid No. (mg KOH/gm)	.005	.001	.006
Color	C2	C2	C2
Conductivity (pS/m) @72F	10.75	99	403
Gums (mg/100ml)	4.2	7.6	15.8
Hydroperoxides (mM)	.016	NE	.011

Evaluation Criteria

Compression Set	Maximum Value	50%
Elongation (%)	Decrease	25%
Hardness, Shore A (pts)	Decrease/Increase	5pts/5pts
Tensile (PSI)	Decrease	25%
Volume Swell (%)	Min/Max	0%/25%

Color - C ,C1--C6 is Clear, light to dark
W = Within Tolerance; O = Out of Tolerance;
NSR = No Specification; NE Not Evaluated; NA = Not Applicable; ND = Not Detected

Table 7. Selected Fuel/Material Data

Material Test Data Non-Metals

Wright Patterson Air Force Base
and the
University of Dayton

Material ID	I.G.5	**Material:**	"O" ring, Fluorosilicone (Parker) L 677-70, Mil-P-25988
Temperature (F):	200	**Use:**	Airframe, Fuel systems gaskets, "O"-Ring
Test date:	09-Jun-94	**Additive/Fuel:**	Betz Dearborn 8Q462 (Normal & x4 Concentrations)/93-POSF-2980
Test Length (days):	28	**Baseline Fuel:**	93-POSF-2980 + (JP8 Additives)

Material Property Tests	post JP8	post JP8+100	post JP8 +100 x 4	Control Material	Evaluations JP8	Evaluations JP8+100	Evaluations JP8+100 x 4
Compression Set	6	9	10	NA	W	W	W
Elongation (%)	199	201	194	231	W	W	W
Hardness, Shore A (pts)	63	63	63	69	W	W	W
Tensile (PSI)	856	857	852	984	W	W	W
Volume Swell (%)	9	9	9	NA	W	W	W

Fuel Property Test	JP8 w/material	JP8 + 100 w/material	JP8+100 x4 w/material
Acid No. (mg KOH/gm)	0.002	0.002	0.003
Color	C1	C1	C1
Conductivity (pS/m) @72F	42	231	399
Gums (mg/100ml)	3.4	5.2	14.2
Hydroperoxides (mM)	0.09	0.03	0

Evaluation Criteria

Compression Set	Maximum Value	30%
Elongation (%)	Decrease	35%
Hardness, Shore A (pts)	Decrease	20pts
Tensile (PSI)	Decrease	45%
Volume Swell (%)	Min/Max	0%/25%

Color - C ,C1--C6 is Clear, light to dark
W = Within Tolerance; O = Out of Tolerance;
NSR = No Specification; NE Not Evaluated; NA = Not Applicable; ND = Not Detected

Table 7. Selected Fuel/Material Data

Material Test Data Non-Metals

Wright Patterson Air Force Base
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Material ID	I.G.5	**Material:**	"O" ring, Fluorosilicone (Parker) L 677-70, Mil-P-25988
Temperature (F):	250	**Use:**	Airframe, Fuel systems gaskets, "O"-Ring
Test date:		**Additive/Fuel:**	Betz Dearborn 8Q462 (Normal & x4 Concentrations)/93-POSF-2980
Test Length (days):	28	**Baseline Fuel:**	93-POSF-2980 + (JP8 Additives)

Material Property Tests	post JP8	post JP8+100	post JP8 +100 x 4	Control Material	Evaluations JP8	JP8+100	JP8+100 x 4
Compression Set	18			NA	W	NE	NE
Elongation (%)	130	225	192	195	W	W	W
Hardness, Shore A (pts)	44	54	58	65	OT	W	W
Tensile (PSI)	162	546	562	984	OT	W	W
Volume Swell (%)	4	9	8	NA	W	W	W

Fuel Property Test	JP8 w/material	JP8 + 100 w/material	JP8+100 x4 w/material

Evaluation Criteria

Compression Set	Maximum Value	30%
Elongation (%)	Decrease	35%
Hardness, Shore A (pts)	Decrease	20pts
Tensile (PSI)	Decrease	45%
Volume Swell (%)	Min/Max	0%/25%

Color - C ,C1--C6 is Clear, light to dark
W = Within Tolerance; O = Out of Tolerance;
NSR = No Specification; NE Not Evaluated; NA = Not Applicable; ND = Not Detected

Table 7. Selected Fuel/Material Data

Wright Patterson Air Force Base
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Material Test Data Non-Metals

Material ID	II.G.2	**Material:**	"O" ring, Fluorosilicone (Parker) L 677-70, Mil-P-25988
Temperature (F):	325	**Use:**	"O" Ring (Airframe /Engine)
Test date:	07-Sep-94	**Additive/Fuel:**	Betz Dearborn 8Q462 (Normal & x4 Concentrations)/93-POSF-2980
Test Length (days):	28	**Baseline Fuel:**	93-POSF-2980 + (JP8 Additives)

Material Property Tests	post JP8	post JP8+100	post JP8 +100 x 4	Control Material	Evaluations JP8	JP8+100	JP8+100 x 4
Compression Set	121	131	139	896	OT	OT	OT
Compression Set	60	60	57	NA	OT	OT	OT
Elongation (%)	88	96	82	214	OT	OT	OT
Hardness, Shore A (pts)	38	40	41	67	OT	OT	OT
Volume Swell (%)	11	10	10	NA	W	W	W

Fuel Property Test	JP8 w/material	JP8 + 100 w/material	JP8+100 x4 w/material
Acid No. (mg KOH/gm)	.003	.01	.004
Color	C3	C3	C3
Conductivity (pS/m) @72F	343	1011	627
Gums (mg/100ml)	12	13.6	20
Hydroperoxides (mM)	.025	.001	NE

Evaluation Criteria

Compression Set	Maximum Value	30%
Elongation (%)	Decrease	35%
Hardness, Shore A (pts)	Decrease	20 pts
Tensile (PSI)	Decrease	45%
Volume Swell (%)	Maximum Value	25%

Color - C ,C1--C6 is Clear, light to dark
W = Within Tolerance; O = Out of Tolerance;
NSR = No Specification; NE Not Evaluated; NA = Not Applicable; ND = Not Detected

Table 7. Selected Fuel/Material Data

Material Test Data - Metals

Wright Patterson Air Force Base
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University of Dayton

Test ID: II.M.18 **Material:** Powder Metallurgy cpm 10V (Rolled Fe, V, CR, C, Mn, SiI, T,S,Mo CPM 10V)

Temperature (F): 325 **Use:** Engine Fuel Lines & Components

Test date: 01-Aug-95 **Additive/Fuel:** Betz Dearborn 8Q462 (Normal and x4 Concentrations)/93-POSF-2980

Test Length (days): 28 **Baseline Fuel:** 93-POSF-2980 + (JP8 Additives)

	Observations						Evaluations		
Material Property Test	**JP8 pre**	**JP8 post**	**JP8+100 pre**	**JP8+100 post**	**JP8+100 x4 Pre**	**JP8+100 x4 Post**	**JP8**	**JP8 +100**	**JP8+ 100x4**
Color	*L2	**L4	*L2	*L3	*L2	*L2	O	W	W
	*Light surface rust (Uniform corrosion), ** Medium Rusting (Uniform corrosion)								
Pitting (Microscopy)	ND	P	ND	P	ND	P	CN	W	W
	pitting - all samples depth< 0.0016"								
Pitting (Visual)	ND	ND	ND	ND	ND	ND	CN	W	W
Average Weight (gms)	32.9016	32.9248	32.7326	32.7569	32.9687	32.9852			
Percent Gain/Loss		0.07		0.07		0.05			

Fuel Property Test	**7 Day**	**28 Day**	**7 day**	**28 day**	**7 day**	**28 day**
Color	C2	C3	C2	C2	C2	C3
Cr (ppb)	ND	6	10	8	15	12
Fe (ppb)	50	180	200	320	1050	1600
V (ppb)	ND	ND	ND	60	30	110
Fuel Property Test	**pre**	**post**	**pre**	**post**	**pre**	**post**
Conductivity (pS/m) @ 72	145	26	312	30	537	324

Fuel Color - C ,C1--C6 is Clear, light to dark; Metal Color - L, L1--L6 is Light, light to dark deposit
W = Within Tolerance O = Out of Tolerance; NSR = No Specification
NE Not Evaluated; NA = Not Applicable; ND = Not Detected CN = Control

Table 8. Fuel/Material Screening Test Results

SCREENING TEST RESULTS *FOR* JP-8 + 100 ADDITIVES *AND* MATERIALS COMPATIBILITY COMPARISON CHART

10 NOV '96
Rev. 13 NOV '96
DHK/UDRI
PAGE 1 OF 3

MATERIAL TEST I.D. / *TYPE* / *TEST DATE*	*PHYSICAL PROPERTIES* / *EVALUATED AT* / *28 DAYS 200° F*	*CONTROL* / *AT ROOM TEMP.* / *NO AGING*	JP-8 FUEL (93 POSF) AGING 28 DAYS / 200 ° F							
			2980	2926	2980	2926	2980	2926		
			NO ADD.	NO ADD.	BETZ	BETZ	BETZ X 4	BETZ X 4		
I.A.2 ADHESIVE FM 47 VINYL PHENOLIC 9/26/96	LAP SHEAR (PSI)	3755	3771	4000/ 2932	2982	3575	3188	3526		
	COHESIVE (%)	100	100	100/ 100	100	100	100	100		
I.A.5 ADHESIVE EPON 828 DETA UN. MOD. EPOXY 9/27/96	LAP SHEAR (PSI)	4294	3879	3565/ 3659	3884	3702	3851	3693		
	COHESIVE (%)	100	100	100/ 100	100	100	100	100		
I.F.5 ESM FOAM FOMEX CLASS I. MIL-F-87260 10/3/96	TENSILE (PSI)	12/ 15	9/ 11	9	11	8	11	8		
	ELONGATION (%)	146/ 118	92/ 87	89	92	90	85	96		
	RESISTIVITY (PS/M)	5.52E+11/ 1.29E+11	2.45E+12 3.92E+11	2.45E+12	3.98E+11	2.21E+12	3.06E+11	2.45E+12		

Table 8. Fuel/Material Screening Test Results (continued)

SCREENING TEST RESULTS *FOR* JP-8 + 100 ADDITIVES *AND* MATERIALS COMPATIBILITY COMPARISON CHART

MATERIAL TEST I.D. *TYPE* *TEST DATE*	*PHYSICAL PROPERTIES* *EVALUATED AT* *28 DAYS 200° F*	*CONTROL* *AT ROOM TEMP.* *NO AGING*	JP-8 FUEL (93 POSF) AGING 28 DAYS / 200 ° F						28 DAYS / 160∫ F	
			2980	2926	2980	2926	2980	2926	2980	2926
			NO ADD.	NO ADD.	1750 MOBIL	1750 MOBIL	1750 MOBIL X 4	1750 MOBIL X 4	BETZ/ X 4	1750/ MOBIL/ X 4
I.A.2 ADHESIVE FM 47 VINYL PHENOLIC 9/26/96	LAP SHEAR (PSI)	3755	3771	4000/ 2932	3575	2717	3575	3016	NO RETEST	2869/ 2950
	COHESIVE (%)	100	100	100/ 100	100	40	100	60	NO RETEST	30/ 34
I.A.5 ADHESIVE EPON 828 DETA UN. MOD. EPOXY 9/27/96	LAP SHEAR (PSI)	4294	3879	3565/ 3659	3591	3357	3595	3464	NO RETEST	3003 2953
	COHESIVE (%)	100	100	100/ 100	100	100	100	80	NO RETEST	44/ 36
I.F.5 ESM FOAM FOMEX CLASS I. MIL-F-87260 10/3/96	TENSILE (PSI)	12/ 15	9/ 11	9	8	8	7	8	NO RETEST	8/ 9
	ELONGATION (%)	146 118	92/ 87	89	83	72	87	74	NO RETEST	88/ 91
	RESISTIVITY (PS/M)	5.52E+11/ 1.29E+11	2.45E+12/ 3.92E+11	2.45E+12	3.06E+12	6.74E+12 1.84E+13	3.31E+12	6.13E+12 3.56E+12	NO RETEST	1.96E+12/ 1.59E+12

Table 8. Fuel/Material Screening Test Results (continued)

SCREENING TEST RESULTS *FOR* JP-8 + 100 ADDITIVES *AND* MATERIALS COMPATIBILITY COMPARISON CHART

Rev. 13 NOV '96
DHK/UDRI
PAGE 3 OF 3

MATERIAL TEST I.D. / *TYPE* / *TEST DATE*	*PHYSICAL PROPERTIES* / *EVALUATED AT* / *28 DAYS 200° F*	*CONTROL* / *AT ROOM TEMP.* / *NO AGING*	JP-8 FUEL (93 POSF) AGING 28 DAYS / 200 °F							
			2980	2926	2926	2926	2926	2926	2926	2926
			NO ADD.	NO ADD.	3190 MOBIL	3190 MOBIL X 4	3111 ETHYL	3111 ETHYL X 4	3263 ETHYL	3263 ETHYL X 4
I.A.2 ADHESIVE FM 47 VINYL PHENOLIC 9/26/96	LAP SHEAR (PSI)	3755	3771	4000	3500	3411	3573	3902	3549	3807
	COHESIVE (%)	100	100	100	100	100	100	100	100	100
I.A.5 ADHESIVE EPON 828 DETA UN. MOD. EPOXY 9/27/96	LAP SHEAR (PSI)	4294	3879	3565	3757	3193	3387	3726	3540	3642
	COHESIVE (%)	100	100	100	100	100	100	100	100	100
I.F.5 ESM FOAM FOMEX CLASS I. MIL-F-87260 10/3/96	TENSILE (PSI)	12/ 15	9/ 11	9	8	8	8	8	11*	11*
	ELONGATION (%)	146/ 118	92/ 87	89	95	85	82	77	121*	130*
	RESISTIVITY (PS/M)	5.52E+11/ 1.29E+11	2.45E+12/ 3.92E+11	2.45E+12	5.82E+12	9.81E+12	3.68E+12	6.13E+12	6.13E+11	9.19E+11

* CREST (CLASS II) *(NOT FOMEX)*

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6. EXTENDED DURATION THERMAL STABILITY TEST RESULTS

A schematic of the EDTST system is shown in Figure 1. The system consists of a 60 gallon feed tank, an electrical motor driven gear pump, two clamshell furnace heaters, and a scrap tank. The primary test articles for the EDTST are the heater, preheater and heat exchanger tubes and two filters (2 and 7 micron).

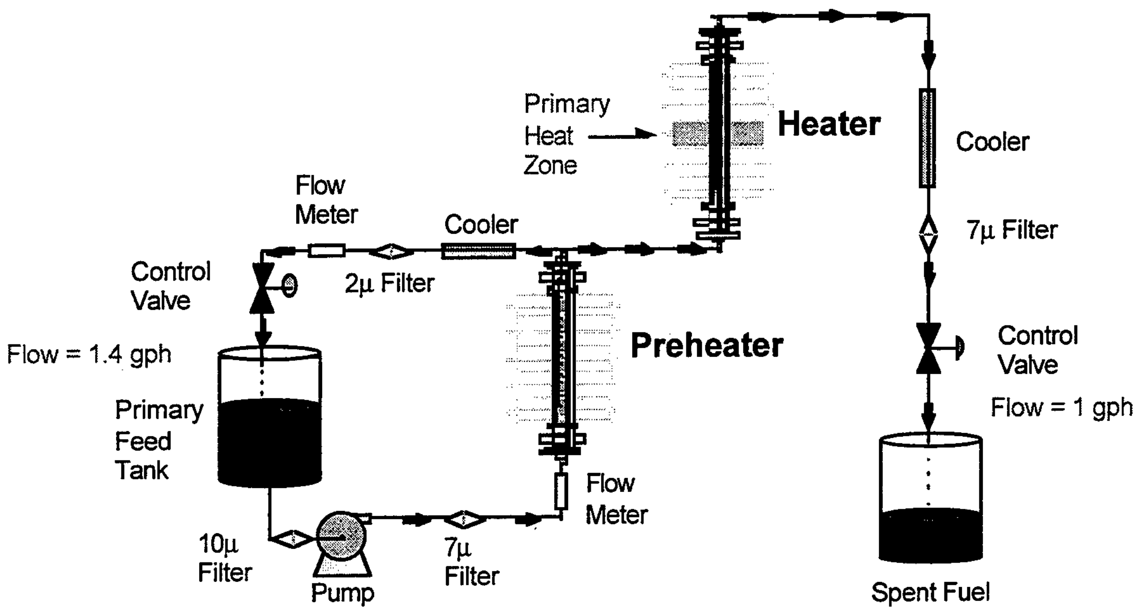

Figure 1. Extended Duration Thermal Stability Test (EDTST) schematic.

The heater deposits relate to deposits that could occur in hot components such as fuel nozzles, heat exchangers or engine nozzle actuators. The segment with the largest deposits is related to the potential deposits in the fuel injection nozzle that could cause decreased flow or complete plugging.

The preheater deposits relate to deposits that could occur in heat exchangers, or engine control system valves (bypass, main control, or nozzle flow divider). The segment with the largest deposit relates to potential plugging that could occur in an engine heat exchanger. Another important aspect of the preheater is deposit that occurs at the exit to the preheater, which is unheated. The engine fuel systems valves are close tolerance and vulnerable to any significant deposits. The tolerances of the valves are in the range of 3 microns. Therefore, any detectable deposit at the exit from the preheater is considered to be unacceptable. The heat exchanger deposits are representative of deposits that could be experienced in a ram/air cooler located in a high temperature bypass line from an engine to an aircraft fuel tank..

The 2μ filter deposit indicates the tendency of the recirculated fuel to form or carry deposits back to the aircraft fuel tanks/components. The 7μ filter deposits are not significant for applications where the fuel is exposed to high temperatures only in the fuel nozzles, since the fuel is immediately sprayed into the engine burner after being subjected to the heater temperatures in the engine nozzles. This filter's deposits are very significant for future application where cooling of high temperature air or other high temperature components is experienced before the fuel enters the engine fuel nozzles. For these applications, tubing and valves will be exposed to fuel deposits as indicated by these filter deposits.

Recommended acceptance criteria for the test articles for meeting JP-8+100 fuel goals are as follows: Deposits in the test articles after this test shall not exceed the following:

Preheater tube maximum segment - 10 $\mu g/cm^2$.

Heat exchanger tube maximum segment - 30 $\mu g/cm^2$.

Heater tube maximum segment - 250 μg/cm.

2 micron filter - 300 μg.

7 micron filter - 10000 μg.

A summary of the test data for the EDTST is shown in Table 9. The test data that exceed the above acceptance criteria are shown in boldface.

Table 9. Summary of EDTST Runs

Test Runs	Fuel	Bulk Temp (F)	Wetted Wall Temp (F)	Filters µg	Maximum Deposits Heater µg/cm^2	Preheater µg/cm^2	Heat Exch. µg/cm^2	Comments
RUN-16	2926	300	500		235	NA	NA	72 hrs
RUN-17	2926	300	550		**771**	NA	NA	72 hrs
RUN-18	2926	350	500	**28,480**-7	**529**	NA	NA	72 hrs
RUN-19	2926	250	500	264-7	**270**	NA	NA	72 hrs
RUN-20	2926	350	450	2,870-7	43	NA	NA	72 hrs
RUN-21	2926	350	500	2,450-7	**283**	NA	NA	72 hrs
RUN-22	2926	375	500	No Data	245	NA	NA	72 hrs - Filter plugged in 13 hours
RUN-23	2926	350	550	**14,660**-7	**1,466**	NA	NA	72 hrs
RUN-24	2926 (JP-8)	350*	450	5,090-7	**1,228**	**85**	**37**	* indicates two pass recirculation
RUN-25	2926 (JP-8)	325*	450	3,260-7	**321**	**14**	11	
RUN-26	2926 (JP-8)	350*	450	**331**-2 **19,310**-7	239	**45**	13	
RUN-27	2926 (JP-8)	350	450	No Data	**414**	NA	NA	
RUN-28	2926	350*	450	**13,690**-2 **7,630**-7	173	**25**	No Data	
RUN-29	2926 (JP-8)	300*	400	284-7	15	No Data	No Data	
RUN-30	2926 (JP-8)	350*	450	**10,500**-7	51	**24**	13	
RUN-31	2926 (JP-8)	350	500	3,530-7	**424**	**11**	NA	
RUN-32	2926 (JP-8) +Betz8Q405&BHT (B&B)	350	500	204-7	14	6	NA	
RUN-33	2926 (JP-8)	350*	450	180-2 4,510-7	67	**17**	No Data	
RUN-34	2926 (JP8) +B&B	350	550	183-7	**367**	NA	NA	
RUN-35	2926 (JP8)	350	500	7,290-7	**914**	10	NA	½ gph
RUN-37	2926 +Mobil 477&BHT/MDA	350	500	1,780-7	201	**38**	NA	
RUN-38	2980	350	500	**88,700**-7	**645**	10	NA	
RUN-39	2980 +B&B	350	500	481-7	49	4	NA	
RUN-40	2980 (JP8) +B&B	350	500	386-7	47	4	NA	
RUN-41	JPTS	425	550	2,150-7	**605**	**117**	NA	
RUN-42	JPTS	350	500	233-7	14	10	NA	
RUN-43	2980 (JP8) +B&B	425	550	**27,420**-7	44	**173**	NA	
RUN-44	2827	350	500	**429,720**-7	**15,726**	**20**	NA	
RUN-45	2827 (JP8) +B&B	350	500	**76,960**-7	**262**	7	NA	
RUN-46	2827	350	450	**58,530**-7	**273**	**15**	NA	
RUN-47	2827 (JP8)	300*	400	2,240-7	80	**15**	5	F22 baseline

Table 9. Summary of EDTST Runs

Test Runs	Fuel	Bulk Temp (F)	Wetted Wall Temp (F)	Filters µg	Maximum Deposits: Heater µg/cm^2	Maximum Deposits: Preheater µg/cm^2	Maximum Deposits: Heat Exch. µg/cm^2	Comments
RUN-48	2926	350	500	**44,170**-7	**1,896**	**25**	NA	
RUN-49	2827 (JP8) +B&B	350*	500	227-2 264-7	**347**	10	6	
RUN-50	JPTS	350	550	3,880-7	16	10	NA	
RUN-51	JPTS	425	550	1,260-7	**267**	**127**	NA	
RUN-52	2980 (JP8) +B&B	350	550	255-7	**888**	7	NA	
RUN-53	JPTS	350*	550	198-2 2,300-7	13	7	No Data	
RUN-54	2827	350	500	**500,440**-7	**2,443**	**12**	NA	Silicosteel
RUN-55	2980 (JP8)	350*	500	**111,150**-7	**9,354**	**104**	28	
RUN-56	2980 (JP8) +Mobil 147B +BHT/MDA (M&B&M)	350	500	433-7	87	10	NA	
RUN-57	2980 (JP8) M&B&M	350	550	522-7	**1,140**	**40**	NA	
RUN-58	2827	350	500	**90,190**-7	**1,636**	10	NA	1/8" OD -.020" wall tube
RUN-59	2980 (JP8) +M&B&M	350*	500	266-2 374-7	38	**13**	No Data	
RUN-61	2980 ARSFSS Run-21	300	450	**27,580**-7	148	6	NA	
RUN-62	2980 (JP8) +Betz 8Q462	350*	500	193-2 559-7	53	**13**	No Data	
RUN-63	2980	300	450	263-7	14	6	NA	
RUN-64	2980 (Used fuel Run-63)	300	450	335-7	37	5	NA	
RUN-65	2827	350	500	**223,920**-7	**561**	NA	NA	
RUN-67	2980	300	450	450-7	31	NA	NA	½" OD ph tube
RUN-68	2980 (JP8) +Betz462	300	450	N.D.	16	NA	NA	2 gph
RUN-69	2827 (JP8)	350	550	**468,660**-7	**4,296**	7	NA	
RUN-71	2980 (JP8) +Betz 462	400*	500	280-2 **22,720**-7	103	**43**	No Data	
RUN-72	2827 (JP8)	350	500	**126,790**-7	**600**	9	NA	
RUN-73	2980 (JP8) +Betz 462	375*	500	**358**-2 6,160-7	95	**14**		
RUN-74	2827 (JP8) +M&B&M	400*	500	218-2 2,350-7	**470**	**307**	**149**	
RUN-75	3084 (JP8)	350	500	**20,150**-7	**4,381**	**14**	NA	
RUN-76	3084 (JP8)	350*	500	**391**-2 **39,200**-7	**8,860**	**53**	No Data	
RUN-77	3084 (JP8) +Betz 462	350*	500	170-2 930-7	102	8	8	

Table 9. Summary of EDTST Runs

Test Runs	Fuel	Bulk Temp (F)	Wetted Wall Temp (F)	Filters µg	Maximum Deposits: Heater µg/cm^2	Preheater µg/cm^2	Heat Exch. µg/cm^2	Comments
RUN-78	2827 (JP8) +M&B&M	350*	500	199-2 276-7	171	**17**	6	
RUN-80	3084 (JP8)	350a	500	95-2 2,330-7	**1,305**	**32**	6	a-active recirculation
RUN-81	3084 (JP8) +1/2M&B&M +JP8d	350a	500	147-2 228-7	74	8	6	
RUN-82	3119 (JP8)	350a	500		**4,260**	**30**	6	
RUN-83	3119 (JP8)	350*	500	86-2 6,390-7	**5,139**	**44**	8	
RUN-84	3119 (JP8)	350a	490	92-2 2,060-7	**2,974**	**24**	6	
RUN-85	3119 (JP8) +B&B&M	350a	500	90-2 330-7	61	4	5	
RUN-86	3084 (JP8) +M1521 +B&M	350a	500	184-2 288-7	**402**	**16**	**287**	
RUN-87	3084 (JP8) + SDA +B&M	350a	500	**500**-2 288-7	61	6	3	
RUN-88	3084 (JP8)	350a	450	115-2 434-7	49	6	8	
RUN-89	3119 (JP8d)	350	500	5,130-7	**1,717**	**15**		
RUN-90	3084 (JP8)	350a	500	279-2 5,260-7	**1,278**	**15**	10	
RUN-91	3119 (JP8) + MDA	350a	500	67-2 1,030-7	217	6	3	
RUN-92	3119 (JP8) +M&B&M	400a	500	**487**-2 **50,370**-7	148	**34**	**72**	
RUN-94	3119 (JP8) + M&B&M	350a	500	245-2 377-7	136	8	6	
RUN-95	3119 (JP8) + B&B&M	400a	500	**1,770**-2 **49,740**-7	188	**30**	**56**	
RUN-96	3084 (JP8) + B&B&M	350a	500	212-2 1,300-7	103	6	6	
RUN-97	3084 (JP8) + MDA	350a	500	146-2 2,640-7	80	5	**34**	
RUN-98	3084 (JP8) + BHT	350a	500	157-2 **18,550**-7	**848**	8	21	
RUN-99	3084 (JP8) + MDA/BHT	350a	500	151-2	137	6	28	
RUN-100	3084 (JP8) +B&B	350a	500	158-2 1,640-7	60	5	4	
RUN-101	3119 (JP8) + BHT	350a	500	No Data	**1,130**	**11**	23	

Table 9. Summary of EDTST Runs

Test Runs	Fuel	Bulk Temp (F)	Wetted Wall Temp (F)	Filters µg	Maximum Deposits Heater µg/cm²	Maximum Deposits Preheater µg/cm²	Maximum Deposits Heat Exch. µg/cm²	Comments
RUN-102	3119 (JP8) + MDA/BHT	350a	500	159-2 5,230-7	164	7	23	
RUN-103	3119 (JP8) + Betz/BHT	350a	500	205-2 1,320-7	75	8	13	
RUN-104	3084)JP8)	350a	500	**395-2 42,470-7**	**1,700**	**12**	18	
RUN-105	3084 (JP8) + B&B&M	350a	500	No Data	33	6	10	
RUN-106	3084 (JP8) + MDA/BHT	350a	500	**368-2** 2,920-7	35	6	5	
RUN-107	3119 (JP8) + MDA/BHT	400a	500	**1,150-2 59,310-7**	**1,363**	**68**	**96**	
RUN-108	3166 (JP8)	350h	500	**12,740-2 17,500-7**	**8,829**	**28**	3	
RUN-109	3119 (JP8) +SDA/BHT/MDA	400h	500	**2,990-2** 653-7	**307**	**64**	**134**	
RUN-110	3084 (JP8) + Mobil/BHT	350a	500	192-2 263-7	156	7	11	
RUN-111	3084 (JP8) + SDA/BHT	350a	500	220-2 2,190-7	113	10	5	
RUN-113 **Rn test ½ gph ½" ph**	3119 (JP8)	350	500		**3,409**	NA	NA	All Reynolds Number (Rn) tests were 50hrs
RUN-114 **Rn test ¾ gph ½" ph**	3119 (JP8)	350	500	**13,070-7**	**2,618**	**23**	NA	Preheater also used in Run-113
RUN-115 **Rn test ½ gph 3/8" ph**	3119 (JP8)	350	500		**3,112**	NA	NA	
RUN-116 **Rn test 1.0 gph 3/8" ph**	3119 (JP8)	350	500		**880**	NA	NA	Same tube as Run-115
RUN117 **Rn test ½ gph ¼" ph**	3119 (JP8)	350	500		**5,304**	NA	NA	
RUN-118 **Rn test 1½ gph ½" ph**	3119 (JP8)	350	500	**13,890-7**	**1,036**	NA	NA	
RUN-121	3166 (JP8)	400a	500	72-2 9,068-7	**8,386**	**181**	**63**	Test stopped after 24 Hrs

Table 9. Summary of EDTST Runs

Test Runs	Fuel	Bulk Temp (F)	Wetted Wall Temp (F)	Filters µg	Maximum Deposits: Heater µg/cm^2	Maximum Deposits: Preheater µg/cm^2	Maximum Deposits: Heat Exch. µg/cm^2	Comments
RUN-122 **Rn test ½ gph ¼" ph**	3119 (JP8) + B&B&M	350	500	386-7	117	NA	NA	
RUN-123 **Rn test ½ gph ¼" ph**	3119 (JP8)	350	500	3,130-7	**2,381**	NA	NA	
RUN-124 **Rn test ½ gph ½" ph**	3119 (JP8)	350	500	9,410-7	**1,345**	NA	NA	
RUN-125	3119 (JP8) + B&B&M	425a	530	**4,620-2** 3,110-7	108	**43**	No Data	6 hr QCT Demo
RUN-126	3166 (JP8) 125% B&B&M	400a	500	23-2 23-7	**269**	**28**	20	
RUN-127	3166 (JP8) + B&B&M	400a	500	240-2 1,310-7	221	**30**	11	
RUN-128 **Rn test ½ gph ¼" ph**	3119 (JP8)	350	500	**13,610-7**	**1,157**	NA	NA	
RUN-129	3119 (JP8)	350	500	No Data.	**4,150**	No Data	NA	Baseline test copper doped fuel 1 gph, 50 hrs, ½" ph, no recirculation.
RUN-130	3166 (JP8) + B&M	400a	500	226-2 **51,740-7**	250	**15**	7	No BHT
RUN-131	3166 (JP8) +200% B&B&M	400a	500	256-2 175-7	147	**11**	12	
RUN-132	3119 (JP8) Cu doped	300a	450	**305-2** 4,690-7	**1,247**	No Data	No Data	
RUN-133 **Rn test ½ gph ½" ph**	3119 (JP8)	350	500	8,650-7	**1,180**	NA	NA	
RUN-135	3166 (JP8) + B&PDA 5%)&M	400a	500	**5,370-2 198,140-7**	**301**	**36**	**265**	
RUN-136	3119 (JP8) +250ppb cu	350a	500	**21,450-2 126,980-7**	**8,587**	43	**173 (also – 132)**	50 Hr test
RUN-137	3119 (JP8) + B&B&M +250ppb cu	350a	500	**46,150-2 78,400-7**	**484**	No Data	No Data	50 Hr test

Table 9. Summary of EDTST Runs

Test Runs	Fuel	Bulk Temp (F)	Wetted Wall Temp (F)	Filters µg	Maximum Deposits Heater µg/cm²	Preheater µg/cm²	Heat Exch. µg/cm²	Comments
RUN-138	3119 (JP8) + M&B&M +250ppb cu	350a	500	**38,640**-2 **49,300**-7	79	**12**	12	50 Hr test
RUN-140	JP-TS	400a	500	**2,230**-2 **31,000**-7	**3,065**	**40**	**116**	
RUN-141	3166 (JP8) +150%Betz + BHT/MDA	400a	500	**2,930**-2 **155,190**-7	245	**22**	**78**	
RUN-142	3166 (JP8) + SDA/B/M	400a	500	No Data	**12,461**	**410**	No Data	Test stopped after 40 hrs due to 100 °F heater temp rise.
RUN-143	3166 (JP8) + B/B/M	400a	500	**1,470**-2 **141,550**-7	172	**23**	**80**	Same fuel used in ARSFSS Run-42
RUN-144	3166 (JP8) + B/B/M	350a	500	214-2 1,030-7	42	3	8	
RUN-145	3166 (JP8) + Ethyl 3263	350a	500	265-2 743-7	**280**	**14**	3	
RUN-146	3166 (JP8) +2xB/B/M	400a	500	284-2 **103,190**-7	149	**19**	**52**	
RUN-147	3166 (JP8) +1.5xB/B/M	385a	500	264-2 415-7	153	10	7	
RUN-148	3119 (JP8) +B/B/M +929ppb Cu	350a	500	**1,900**-2 **68,950**-7	**342**	No Data	No Data	Fuel stored at 140 °F for 30 days with all additives.
RUN-149	3166 (JP8) + B/B/M +839ppb Cu	350a	500	**2,190**-2 **48,070**-7	**771**	**35**	**313**	
RUN-150	3166 (JP8) +B/B/M +607ppb Cu	350a	500	**3,110**-2 **29,640**-7	**441**	No Data	No Data	
RUN-151	3166 (JP8) + B/B/M +518ppb Cu	350a	500	**2,260**-2 **60,670**-7	**385**	**41**	**260**	
RUN-153	3166 (JP8) + Ethyl 3300	350a	500	24-2 32-7	150	**11**	5	
RUN-154	3305 (JP8)	350a	500	213-2 **80,880**-7	**414**	5	14	
RUN-155	3305 (JP8) + B/B/M +518ppb Cu	350a	500	**2,750**-2 **73,520**-7	**2,448**	**44**	**190**	
RUN-157	3166 (JP8) + B/B/M	350a	500	209-2 663-7	93	4	6	
RUN-158	3166 (JP8) +Ethyl +BHT/MDA	350a	500	**3,390**-2 7,950-7	**1,590**	4	4	

Table 9. Summary of EDTST Runs

Test Runs	Fuel	Bulk Temp (F)	Wetted Wall Temp (F)	Filters µg	Maximum Deposits			Comments
					Heater $\mu g/cm^2$	Preheater $\mu g/cm^2$	Heat Exch. $\mu g/cm^2$	
RUN-159	JP7	425a	550	45-2 458-7	18	4	15	
RUN-160	3084 (JP8) + Betz462	400a	500	**2,020**-2 **90,000**-7	185	**26**	**136**	
RUN-161	3166 (JP8) + Ethyl 3345	350a	500	**8,700**-2 **19,540**-7	228	**19**	6	
RUN-162	3166 (JP8) + Ethyl 3346	350a	500	181-2 251-7	105	10	4	LECO problems suspected (test to be repeated)
RUN-163	3305 (JP8) (Suspect Betz) +140ppb Cu	300a	400	170-2 **14,030**-7	22	3	17	50Hr test
RUN-164	3166 (JP8) + Betz 462	350a	500	287-2 470-7	72	3	10	
RUN-165	3166 (JP8) + Ethyl 3346	350a	500	**310**-2 364-7	116	7	8	Repeat of Run-162
RUN-166	3305 (JP8) + Betz 462 +410ppb Cu	350a	500	**305**-2 **11,490**-7	60	3	**16**	
RUN-167	3219 (JP8)	350a	500	163-2 **40,530**-7	**9,924**	7	5	
RUN-168	3219 (JP8) + Betz 462	350a	500	163-2 453-7	64	3	5	
RUN-169	3219 (JP8) + Mobil/B/M	350a	500	164-2 165-7	**282**	3	5	
RUN-170	3219 (JP8) + SDA/B/M	350a	500	171-2 279-7	35	7	5	
RUN-171	3219 (JP8) + Octel1755	350a	500	217-2 336-7	41	3	7	
RUN-172	3219 (JP8) + Ethyl 3346	350a	500	187-2 167-7	125	6	7	
RUN-173	3219 (JP8) + Betz 462	400a	500	179-2 565-7	**255**	3	4	
RUN-174	3219 (JP8) + SDA /BHT/MDA	400a	500	158-2 352-7	38	**13**	12	
RUN-175	3219 (JP8) + Ethyl 3357	400a	500	210-2 384-7	205	**48**	10	
RUN-176	3219 (JP8) + Ethyl 3407	350a	500	BTD BTD	59	7	5	
RUN-182	3219 (JP8) + Ethyl 5323	350a	500	220-2 120-7	35	3	5	
RUN-183	3219 (JP8) + Ethyl 5323	400a	500	200-2 924-7	78	**33**	7	

Table 9. Summary of EDTST Runs

Test Runs	Fuel	Bulk Temp (F)	Wetted Wall Temp (F)	Filters µg	Maximum Deposits Heater µg/cm^2	Preheater µg/cm^2	Heat Exch. µg/cm^2	Comments

Notes:

1. Duration of tests was 96 hours unless otherwise indicated.
2. The 2 and 7 micron filters are identified by (-2) and (-7), respectively.
3. A test series to evaluate Reynolds Number (Rn) sensitivity was initiated, but was not completed due to higher priority tests.
4. Bold indicates unacceptable deposits.

7. ADVANCED REDUCED SCALE FUEL SYSTEM SIMULATOR RESULTS

The ARSFSS is capable of simulating thermal and flow profiles of aircraft fuel systems. It also has valves that are representative of actual aircraft. The simulator consists of three major systems. These systems are the fuel conditioning system, the airframe fuel system simulator and the engine fuel system simulator. A schematic of this Simulator is shown in Figure 2. The simulator is configured for simulating an F-22 aircraft with an F119 engine. The flow established for the simulator is approximately 1/72 scale of the F119 engine. The burn flow for the simulator is 1/3 of the flow for a single F119 fuel nozzle. The total flow that is required for each test is approximately 1,500 gallons.

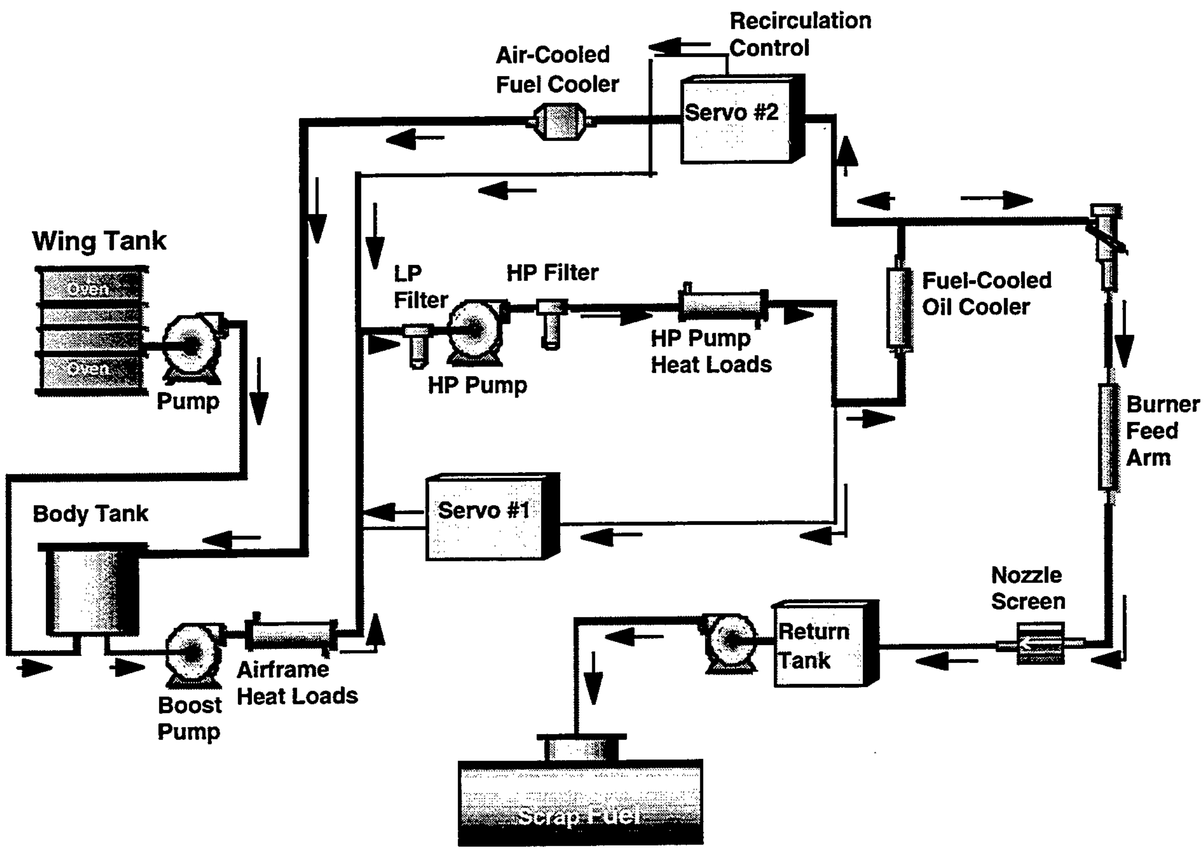

Figure 2. Advanced Reduced Scale Fuel System Simulator (ARSFSS) schematic.

The primary test articles contained in the simulator are (1) the fuel cooled oil cooler (FCOC), (2) the flow divider valve, (3) the burner feed arm (BFA), and (4) servovalves #1 and 2. The FCOC (Figure 2) represents the engine lube system cooler. It consists of an induction heater and a steel manifold with three 3/8" - .035 inch wall tubes and associated thermocouples. The tubes are connected and provide for three passes through the heater. The tube that is used for the final pass through the heater is removed

after each test. It is, then, cut into 2 inch segments and subjected to carbon analysis. The flow divider valve is an actual F119 valve that has been modified by changing the slot width for the reduced flow. The materials, clearances and function are representative of the F119 flow divider valve. The performance of this valve is determined by hysteresis and visual inspection. The burner feed arm is RF induction heated. It consists of a steel clamshell with a 1/8 inch - .020 inch wall stainless steel tube installed in the middle of the clamshell. Thermocouples on the outside of the tube are located along the entire length to measure the temperature profile of the tube. At the end of the tests, this tube is cut up into 1 inch sections and subjected to carbon burnoff. The servovalves are electrohydraulic valves used in the engine control system. The materials and clearances are representative of the actual engine valves. The performance of these valves is determined by hysteresis and visual inspection.

A summary of the tests conducted by the ARFSS is shown in Table 10. All tests consisted of 75 missions (150 hours approximately) of a generic F-22 aircraft duty cycle.

Table 10. Summary of ARSFSS Runs.

RUN-#	Fuel	Bulk Temp (F)	Wetted Wall Temp (F)	Maximum Deposits BFA µg/cm²	FCOC µg/cm²	Visual Valve Deposits	Comments
RUN#19	2980	300	450	**878**			
RUN#20	2980	300	450	**657**		slight	
RUN#21	2980	300	450	**982**		slight	No Recirculation
RUN#22	2980 (JP-8) +Betz 8Q405 +BHT	300	450	27		none	
RUN#23	2980 (JP-8)	300	450	263		slight	
RUN#24	2980	300	450	**1,287**		**significant**	
RUN#25	2980 (JP-8)	300	450	296		slight	
VICKERS PUMP INSTALLED							
RUN#26	2980 (JP-8)	300	450	10		slight	
RUN#27	2980	300	450	91		slight	
ALL of the following tests are with recirculation unless noted otherwise.							
RUN#28	2980 (JP-8)	325	450	49		slight	
RUN#29	3119 (JP-8)	350	500	**4,556**		**significant**	
RUN#30	3119 (JP-8) +Betz 8Q405 +BHT	350	500	41		slight	
RUN#31	3119 (JP-8) +Mobil 147B +BHT +MDA	350	500	81		slight	
RUN#32	3119 +Betz 8Q405 +BHT & +JP-8 ALTERNATELY	350	500			slight	
RUN#33	3119 (JP-8) +Betz 8Q405 +BHT + MDA & +Mobil 147B +BHT +MDA CO-Mingled	350	500	46		slight	
RUN#34	3119 (JP-8)	350	500	**1,166**			Rn Test-50 Hrs 10.7 pph (2500 Rn) No Recirculation
RUN#35	3119 (JP-8)	350	500	44			Rn Test-50 Hrs 21.4 pph (5000 Rn) No Recirculation
RUN#37	3119 (JP-8) +BHT +MDA	350	500	58		slight	

Table 10. Summary of ARSFSS Runs.

RUN-#	Fuel	Bulk Temp (F)	Wetted Wall Temp (F)	Maximum Deposits BFA μg/cm²	FCOC μg/cm²	Visual Valve Deposits	Comments
RUN#38	3119 (JP-8) +SDA +BHT +MDA	350	500	73		none	
RUN#39	3166 (JP-8) +Betz 8Q462	400	500	106	**81**	**significant**	
RUN#40	3166 (JP-8) +Betz 8Q462	375	500	115	12	none	
RUN#41	3166 (JP-8) +200% Betz 8Q405 +BHT +MDA	400	500	73	**26**	**significant**	
RUN#43	3166 (JP-8) +Betz 8Q462	385	500	75	**19**	**significant**	
RUN#44	3166 (JP-8) +150% Betz 8Q405 +BHT +MDA	400	500	82	**24**	**significant**	315 °F Bypass
RUN#47	3166 (JP-8)	350	500	**5,441**	**60**	**significant**	
RUN#48	3166 (JP-8) +Betz8Q462	400	500	15	**53**	slight to **significant**	

Notes:
1. All runs were with recirculation except as noted.
2. The visual valve deposits were on servo#2 and the flow divider valves.
3. A test series to evaluate Reynolds Number (Rn) sensitivity were conducted similar to the EDTST.
4. Bold indicates unacceptable deposits.

8. CONCLUSIONS

This report consists of data set summaries of tests performed in support of the development of advanced jet fuels, including JP-8+100, JP-900, and endothermic fuels. For the development of JP-8+100 fuel, we have tested hundreds of additives in both small and large scale test devices. We formulated combinations of the best additives (detergent/dispersant, hindered phenol antioxidant, and metal deactivator) and demonstrated their efficacy in reducing deposition in realistic aircraft conditions in large-scale simulator rigs. We optimized the concentrations of these additives for maximum effectiveness and minimum cost. We performed extensive studies of the compatibility of these fuel additives with current and future aircraft fuel system materials. We determined that the current best additives show no negative effects on both metallic and non-metallic fuel system materials.

We also performed extensive studies on the fundamental processes of fuel oxidation, deposition, and pyrolysis. We developed chemical kinetic mechanisms which can simulate the oxidation and deposition processes. We performed experimental and modeling studies on fuel cooling which shows that deposition which occurs in fuel cooling heat exchangers can be a significant problem in fuel system design. We demonstrated an inverse relationship between oxidation and deposition over a range of fuels, and showed that our chemical kinetic mechanism can be used to explain this seemingly anomalous result. We developed statistical techniques to assist the evaluation of jet fuel additives, thermal stability measurements, and aircraft field performance. We developed a wide variety of fuels analysis techniques for measurement of the following: dissolved oxygen, detergent/dispersant capacity, antioxidants and phenolics, hydroperoxides, trace jet fuel compounds, metal deactivators, products of endothermic reforming, dissolved and free water in fuel, BHT, Betz dispersant, and elemental metals. We explored alternative techniques for reducing jet fuel deposition including: removal of dissolved oxygen, silylating agents, oxygen scavenging additives, and solid-phase extraction.

We also made progress in support of development of future fuels such as JP-900 and endothermic fuels. We explored the effect of supercritical fluid properties on high temperature fuels. We have begun to study the pyrolysis of fuel in catalytic and non-catalytic reaction systems.

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REFERENCES

(1) Klavetter, E. A., Martin, S. J., and Wessendorf, K. O., 1993, "Monitoring Jet Fuel Thermal Stability Using a Quartz Crystal Microbalance," *Energ. Fuels,* Vol. 7, pp. 582-588.

(2) Zabarnick, S., 1994, "Studies of Jet Fuel Thermal Stability and Oxidation Using a Quartz Crystal Microbalance and Pressure Measurements," *Ind. Eng. Chem. Res.,* Vol. 33, pp. 1348-1354.

(3) Zabarnick, S., and Whitacre, S. D., 1998, "Aspects of Jet Fuel Oxidation," *J. Eng. Gas Turbines Power,* Vol. 120, pp. 519-525.

(4) Zabarnick, S., and Grinstead, R. R., 1994, "Studies of Jet Fuel Additives using the Quartz Crystal Microbalance and Pressure Monitoring at 140 C," *Ind. Eng. Chem. Res.,* Vol. 33, pp. 2771-2777.

(5) Zabarnick, S., 1994, "Evaluation of Jet Fuels and Jet Fuel Additives Using the Quartz Crystal Microbalance and Pressure Measurements," University of Dayton Research Institute, UDR-TR-94-63.

(6) Zabarnick, S., Zelesnik, P., and Whitacre, S. D., 1995, "Evaluation of Jet Fuels and Jet Fuel Additives Using the Quartz Crystal Microbalance and Pressure Measurements. Part II.," University of Dayton Research Institute, UDR-TR-95-98.

(7) Zabarnick, S., Whitacre, S. D., and Mick, M. S., 1997, "Evaluation of Jet Fuels and Jet Fuel Additives Using the Quartz Crystal Microbalance and Pressure Measurements. Part III.," University of Dayton Research Institute, UDR-TR-97-108.

(8) Zelesnik, P., 1995, "Studies of Jet Fuel Thermal Stability, Oxidation and Additives Using the Quartz Crystal Microbalance and Oxygen Monitoring," M.S. Thesis, University of Dayton.

(9) Grinstead, R., 1994, "Evaluation of JP-8+100 Additives by the Isothermal Corrosion Oxidation Test and the Microcarbon Residue Test," University of Dayton Research Institute, UDR-TR-94-63.

(10) Heneghan, S. P., Martel, C. R., Williams, T. F., and Ballal, D. R., 1993, "Studies of Jet Fuel Thermal Stability in a Flowing System," *J. Eng. Gas Turbines Power,* Vol. 115, pp. 480-490.

(11) Katta, V. R., Jones, E. G., and Roquemore, W. M., 1997, "Modeling of Deposition Process in Liquid Fuels," ASME, 97-3040.

(12) Chin, L. P., Katta, V. R., and Heneghan, S. P., 1994, "Computer Modeling of Deposits Formed in Jet Fuels," *Prepr.-Am. Chem. Soc., Div Pet. Chem.,* Vol. 39, pp. 19-25.

(13) Heneghan, S. P., Martel, C. R., Williams, T. F., and Ballal, D. R., 1995, "Effects of Oxygen and Fuel Additives on the Thermal Stability of Jet Fuels," *J. Eng. Gas Turbines Power,* Vol. 117, pp. 120-124.

(14) Ervin, J. S., Williams, T. F., and Katta, V. R., 1996, "Global Kinetic Modeling of Aviation Fuel Fouling in Cooled Regions in a Flowing System," *Ind. Eng. Chem. Res.,* Vol. 35, pp. 4028-4032.

(15) Zabarnick, S., 1998, "Chemical Kinetic Modeling of Antioxidant Chemistry for Jet Fuel Applications," *Energ. Fuels,* Vol. 12, pp. 547-553.

(16) Ervin, J. S., and Zabarnick, S., 1998, "Computational Fluid Dynamics Simulations of Jet Fuel Oxidation Incorporating Pseudo-Detailed Chemical Kinetics," *Energ. Fuels,* Vol. 12, pp. 344-352.

(17) Heneghan, S. P., Zabarnick, S., Ballal, D. R., and Harrison, W. E., 1996, "JP-8+100: Development of a Thermally Stable Jet Fuel," *J. Energy Res. Tech.,* Vol. 118, pp. 170-179.

(18) Williams, T. F., Martel, C. R., and Blust, J., 1994, "Studies of Thermal Stability of Jet Fuels, Vol. I: Experimental Work," University of Dayton Research Institute, UDR-TR-94-10.

(19) Williams, T. F., Martel, C. R., and Blust, J., 1994, "Studies of Thermal Stability of Jet Fuels, Vol. II: Data Sets," University of Dayton Research Institute, UDR-TR-94-11.

(20) Rubey, W. A., Striebich, R. C., Tissandier, M. D., Tirey, D. A., and Anderson, S. D., 1995, "Gas Chromatographic Measurement of Trace Oxygen and Other Dissolved Gases in Thermally Stressed Jet Fuel," *J. Chrom. Sci.,* Vol. 33, pp. 433-437.

(21) Kalt, D. H., 1997, "Fuel and Fuel System Materials Compatibility Test Program for a JP-8+100 Fuel Additive," University of Dayton Research Institute, UDR-TR-97-01.